SAP Worksheet No. 1 – Title and Approval Page
(UFP-SAP Manual Section 2.1)

FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
February 2010

Remedial Investigation
Lower Darby Creek Area Site
Clearview Landfill
Philadelphia, Pennsylvania

Prepared for:
USEPA Region III

Prepared by:
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Prepared under:
USEPA Contract Number EP-S3-07-04
Work Assignment # 023

Review Signatures:

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Tetra Tech

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JC Kim, P.E./Project Manager/Date
Tetra Tech

Approval Signatures:

_____
Josh Barber/RPM/Date
USEPA Region III

_____
Quality Assurance Chemist/Date
USEPA Region III QA Team

SAP Worksheets

REFERENCES

APPENDICES

Appendix A - Tetra Tech Standard Operating Procedures
Appendix B - Figures

Acronyms

°C	Degrees Celsius
%D	Percent Difference
%R	Percent Recovery
µg/L	Micrograms per Liter
ASTM	American Society for Testing Materials
BERA	Baseline Environmental Risk Assessment
BFB	Bromofluorobenzene
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cis-1,2-DCE	cis-1,2-Dichloroethene
CLASS	Contract Laboratory Analytical Support Services
CLP	Contract Laboratory Program
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CRQL	Contract Required Quantitation Limit
DAS	Delivery of Analytical Services
DFTPP	Decafluorotriphenylphospine
DMC	Deuterated Monitoring Compound
DO	Dissolved Oxygen
DQI	Data Quality Indicator
DQO	Data Quality Objective
EICP	Extracted Ion Current Profile
ESAT	Environmental Services and Assistance Team
FOL	Field Operations Leader
FS	Feasibility Study
ft bgs	Feet Below Ground Surface
FTMR	Field Task Modification Request
GAC	Granular Activated Carbon
GC	Gas Chromatograph
GC/ECD	Gas Chromatograph/Electron Capture Detector
GC/MS	Gas Chromatograph/Mass Spectrometer
GW	Groundwater
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HDPE	High Density Polyethylene
HNO_3	Nitric Acid
HSM	Health and Safety Manager
HSO	Health and Safety Officer
IC	Ion Chromatograph
ICB	Initial Calibration Blank
ICIAP	Institutional Control Implementation and Assurance Plan
ICP-MS	Inductively Coupled Plasma-Mass Spectrometer
ICS	Interference Check Sample
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IDW	Investigation-Derived Waste
IS	Internal Standard
ISCO	In-situ Chemical Oxidation
L	Liter
LCS	Laboratory Control Sample
LDCA	Lower Darby Creek Area
MD	Matrix Duplicate
MDL	Method Detection Limit

Acronyms (Continued)

mg/kg	Milligram per Kilogram
mL	Milliliter
MPC	Measurement Performance Criteria
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Monitoring Well
NA	Not Applicable
Na_3PO_4	Sodium Phosphate
OASQA	Office of Analytical Services and Quality Assurance
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
oz	Ounce
pg/L	Picogram per Liter
PADEP	Pennsylvania Department of Environmental Protection
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PB	Preparation Blank
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PDF	Portable Document Format
PDI	Pre-design Investigation
PFK	Perfluorokerosene
PID	Photoionization Detector
PM	Project Manager
PQOs	Project Quality Objectives
PRG	Preliminary Remediation Goals
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RA	Remedial Action
RAC	Remedial Action Contract
RAO	Remedial Action Objective
RAS	Regular Routine Analytical Services
RD	Remedial Design
RI	Remedial Investigation
RLSC	Regional Laboratory Services Coordinator
ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factor
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SLERA	Screening Level Ecological Risk Assessment
SMO	Sample Management Office
SOP	Standard Operating Procedure
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TAT	Turnaround Time
TBD	To Be Determined
TCE	Trichloroethene
TCL	Target Compound List

Acronyms (Continued)

TCL	Target Compound List
TR/COC	Traffic Report/Chain of Custody
TtNUS	Tetra Tech NUS, Inc.
UFP-SAP	Uniform Federal Policy for Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WA	Work Assignment
ZL	Zero Level

SAP Worksheet #2 – SAP Identifying Information

Site Number/Code: **PASFN0305521**
Contractor Name: **Tetra Tech NUS, Inc. (TtNUS)**
Contractor Number: **EP-S3-07-04**
Contract Title: **RAC 2**
Work Assignment Number: **023-RICO-D366**

1. Identify guidance used to prepare SAP: Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) Guidance, USEPA QA/R-5, USEPA QA/G-5

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Remedial Investigation (RI)

3. Identify approval entity: United States Protection Agency (USEPA) Region III Quality Assurance Team, Fort Meade, Maryland

4. Indicate whether the SAP is a generic or a ***project-specific*** SAP. (circle one)

5. List dates of scoping sessions that were held:

   General scoping sessions: See Worksheet #9

6. List dates and titles of SAP documents written for previous site work, if applicable:

Title	Received Date
Quality Assurance Project Plan	January 2002

7. List organizational partners (stakeholders) and connection with lead organization: USEPA (regulatory)

8. List data users: USEPA (regulatory), TtNUS, (RI Contractor)

9. If any required SAP elements and required information are not applicable to the project, then circle the omitted SAP elements and required information on the attached table. Provide an explanation for their exclusion below:

   Not Applicable (NA) because all worksheets have been completed.

Required SAP Element(s) and Corresponding SAP Section(s)	Crosswalk to Required Documents	Optional SAP Worksheet # in SAP Workbook	Required Information
Project Management and Objectives			
Title and Approval Page		1	- Title and Approval Page
1.1 Document Format 1.1.1 Document Control Format 1.1.2 Document Control Numbering System 1.1.3 SAP Identifying Information		2	- Table of Contents - SAP Identifying Information
1.2 Distribution List and Project Personnel Sign-Off Sheet 1.2.1 Distribution List 1.2.2 Project Personnel Sign-Off Sheet		3 4	- Distribution List - Project Personnel Sign-Off Sheet
1.3 Project Organization Project Organizational Chart 1.3.1 Communication Pathways 1.3.2 Personnel Responsibilities and Qualifications 1.3.3 Special Training Requirements and Certification		5 6 7 8	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
1.4 Project Planning/Problem Definition 1.4.1 Project Planning (Scoping) 1.4.2 Problem Definition, site History, and Background		9 10	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, site History, and Background - site Maps (historical and present)
1.5 Project Quality Objectives and Measurement Performance Criteria 1.5.1 Development of Project Quality Objectives Using the Systematic Planning Process 1.5.2 Measurement Performance Criteria		11 12 37	- Site-Specific PQOs - Measurement Performance Criteria Table - Usability assessment
1.6 Secondary Data Evaluation		13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table -ROD and RI/FS Data
1.7 Project Overview and Schedule 1.7.1 Project Overview 1.7.2 Project Schedule		14 15 16	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table

Required SAP Element(s) and Corresponding SAP Section(s)	Crosswalk to Required Documents	Optional SAP Worksheet # in SAP Workbook	Required Information
Measurement/Data Acquisition			
2.1 Sampling Tasks 2.1.1 Sampling Process Design and Rationale 2.1.2 Sampling Procedures and Requirements 2.1.2.1 Sampling Collection Procedures 2.1.2.2 Sample Containers, Volume, and Preservation 2.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 2.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 2.1.2.5 Supply Inspection and Acceptance Procedures 2.1.2.6 Field Documentation Procedures		17 18 19 20 21 22	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
2.2 Analytical Tasks 2.2.1 Analytical SOPs 2.2.2 Analytical Instrument Calibration Procedures 2.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 2.2.4 Analytical Supply Inspection and Acceptance Procedures		23 24 25	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
2.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 2.3.1 Sample Collection Documentation 2.3.2 Sample Handling and Tracking System 2.3.3 Sample Custody		26 27	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal
2.4 Quality Control Samples 2.4.1 Sampling Quality Control Samples 2.4.2 Analytical Quality Control Samples		28	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree

Required SAP Element(s) and Corresponding SAP Section(s)	Crosswalk to Required Documents	Optional SAP Worksheet # in SAP Workbook	Required Information
2.5 Data Management Tasks 2.5.1 Project Documentation and Records 2.5.2 Data Package Deliverables 2.5.3 Data Reporting Formats 2.5.4 Data Handling and Management 2.5.5 Data Tracking and Control		29 30	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs
2.6 Equipment Decontamination 2.7 Waste Handling		14	
Assessment/Oversight			
3.1 Assessments and Response Actions 3.1.1 Planned Assessments 3.1.2 Assessment Findings and Corrective Action Responses		31 32	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table
3.2 QA Management Reports		33	- QA Management Reports Table
3.3 Outline of Project Report			NA
Data Review			
4.1 Overview			
4.2 Data Review Steps 4.2.1 Step I: Verification 4.2.2 Step II: Validation 42.2.1 Step IIa Validation Activities 4.2.2.2 Step IIb Validation Activities 4.2.3 Step III: Usability Assessment 4.2.3.1 Data Limitations and Actions from Usability Assessment 4.2.3.2 Activities		34 35 36 37	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment
4.3 Streamlining Data Review			NA

SAP Worksheet #3 – Distribution List

Distribution List

SAP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Josh Barber	Remedial Project Manager (RPM)	USEPA Region III	215-814-3393	215-814-3025	Barber.Josh@epamail.epa.gov	NA
JC Kim	Project Manager (PM)/Site Manager	TtNUS	302-283-2235	302-454-5988	jc.kim@tetratech.com	NA
Chris Sollenberger	Hydrogeologist	TtNUS	302-283-2239	302-454-5988	Chris.sollenberger@tetratech.com	NA
Eric Watt	Field Operations Leader (FOL) – Drilling & GW Sampling Tasks Site Safety Officer (SSO) Regional Laboratory Services Coordinator (RLSC)	TtNUS	302-283-2221	302-454-5988	eric.watt@tetratech.com	NA
Megan Ritchie	Quality Assurance Manager (QAM)	TtNUS	610-382-1527	610-491-9645	megan.ritchie@tetratech.com	NA

SAP Worksheet #4 – Project Personnel Sign-Off Sheet

Project Personnel Sign-Off Sheet

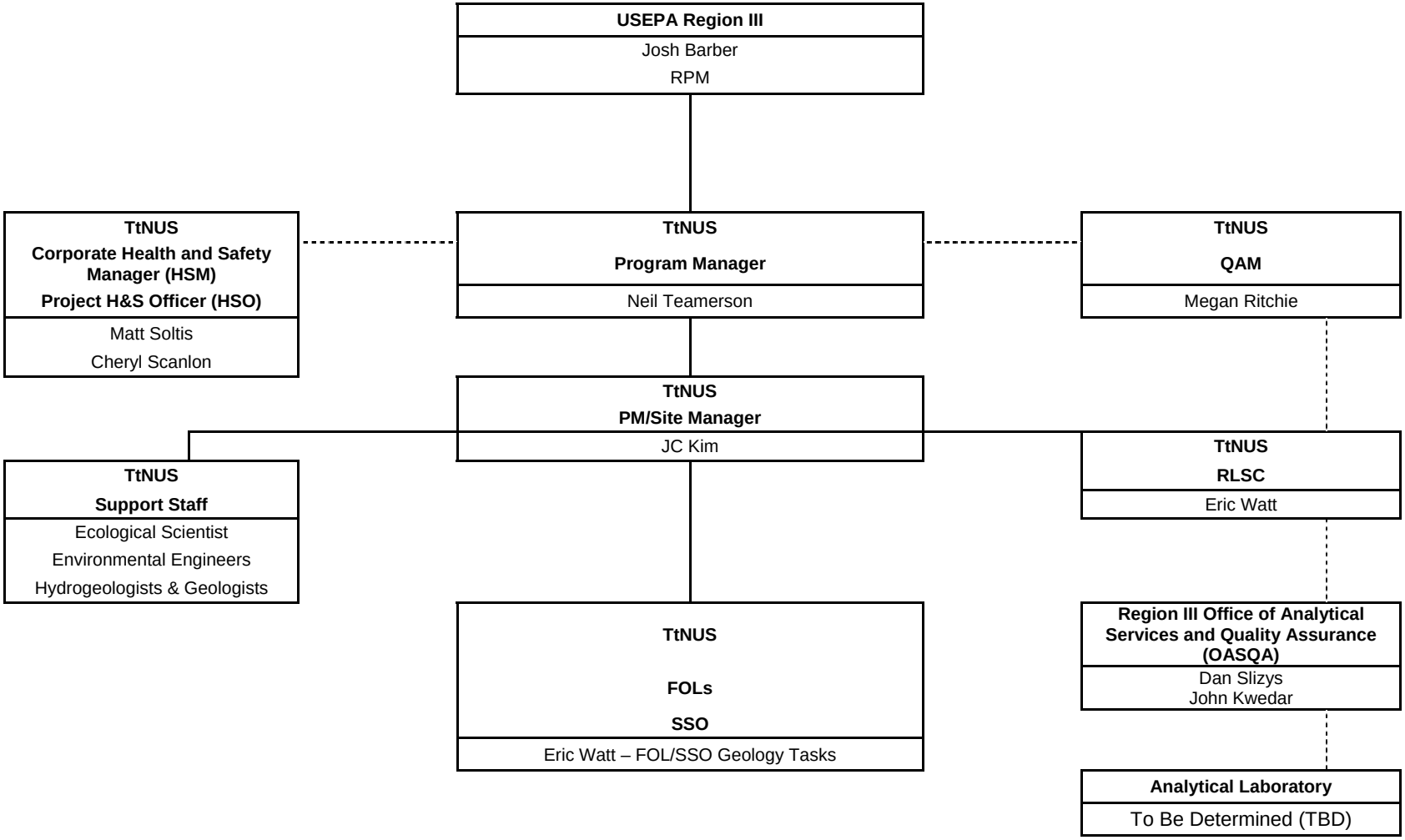
Organization: Tetra Tech NUS, Inc.

Project Personnel	Title	Telephone Number	Signature	Date SAP Read Email Receipt
J.C. Kim	PM / Site Manager	302-283-2235		
Chris Sollenberger	Hydrogeologist	302-283-2239		
Eric Watt	FOL/SSO/RLSC	302-283-2221		
Megan Ritchie	QAM	610-382-1527		

SAP Worksheet #5 – Project Organization Chart

Line of Communication- - - - - - - - -
Line of Authority _____

PROJECT ORGANIZATION CHART



SAP Worksheet #6 – Communication Pathways

Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field Task Modification Requests (FTMR)	TtNUS FOL TtNUS PM	Eric Watt JC Kim	302-283-2221 302-283-2235	If field changes are required, FOL Immediately gets approval from PM via telephone. Field change documented via FTMR form and entered in field log book.
SAP Amendments	Tetra Tech PM USEPA RPM	JC Kim Josh Barber	302-283-2235 215-814-3393	If SAP amendments are required, PM will Immediately inform EPA RPM and follow-up with formal correspondence (e.g., SAP Amendment letter) within 2-weeks of identified change.
Changes in Schedule	TtNUS PM USEPA RPM	JC Kim Josh Barber	302-283-2235 215-814-3393	PM to immediately inform EPA RPM of schedule changes, and follow-up via schedule impact letter within 2-weeks of recognized change.
Issues in the field that result in changes in scope of field work	TtNUS FOL TtNUS Hydrogeologist TtNUS PM USEPA RPM	Eric Watt Chris Sollenberger JC Kim Josh Barber	302-283-2221 302-283-2239 302-283-2235 215-814-3393	FOL informs PM and Hydrogeologist; PM informs RPM; RPM issues scope change if warranted; Scope change to be approved by RPM before work is executed.
Recommendations to stop work and initiate work upon corrective action	TtNUS FOL/SSO TtNUS Hydrogeologist TtNUS PM TtNUS QAM TtNUS HSO USEPA RPM	Eric Watt Chris Sollenberger JC Kim Megan Ritchie Cheryl Scanlon Josh Barber	302-283-2221 302-283-2251 302-283-2274 610-382-1527 302-738-7551 215-814-3393	Responsible Party immediately informs subcontractors, the USEPA, and Project Team
Analytical data quality issues	OASQA (Routine Analytical Services [RAS] Coordinator) OASQA (Delivery of Analytical Services [DAS] Coordinator) TtNUS RLSC TtNUS QAM	Dan Slizys John Kwedar Eric Watt Megan Ritchie	410-305-2734 410-305-3021 302-283-2221 610-382-1527	OASQA Client Services Team to immediately notify the Tetra Tech RLSC. Notify Data Validation Staff and Tetra Tech PM, if necessary.

OUT OF CONTROL EVENTS

An out-of-control event is defined as any deviation from the sampling and analysis procedures due to circumstances and/or conditions beyond the samplers or laboratory control. Some examples of these conditions and circumstances are as follows: (1) health and safety situations, such as explosive atmosphere conditions; (2) unforeseen site conditions, such as bedrock at shallow depth at a boring location; and (3) laboratory conditions, such as power outages that may cause a loss of data.

Responses to Out-of-Control Events

The TtNUS Site Manager will be responsible for identification of an out-of-control field event. The USEPA will be responsible for the identification of these events in the laboratory. Upon recognition or identification of an out-of-control event in the field, the TtNUS Site Manager will have work stop and shift to a different, unaffected activity/task if possible. The Site Manager will notify, as soon as possible, the appropriate field personnel. The field personnel will have the responsibility of providing documentation of the event and will coordinate and recommend corrective actions.

In the event an out-of-control event occurs in the laboratory, TtNUS will notify the USEPA RPM who will determine the appropriate course of action.

Re-evaluation of Laboratory Control Limits

Re-evaluation of laboratory control limits after an out-of-control event will be the responsibility of the QAM in coordination with the USEPA Project Manager and the TtNUS Site Manager. Wherever possible, the breakage sample or quality control (QC) samples will be analyzed in place of the matrix sample using the laboratory control limits that apply to the matrix samples.

Documentation of Out-of-Control Events and Corrective Actions

The field personnel will be responsible for the correct and complete documentation of out-of-control events and corrective actions taken. For each event corrective action, an Out-of-Control Event and Disposition Action Report form will be filled out.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
J.C. Kim	PM / Site Manager	TtNUS	Oversees project, financial, schedule, and technical day to day management of the project.	PhD, P.E., Environmental & Civil Engineering, 20 years experience
Chris Sollenberger	Hydrogeologist	TtNUS	Oversees implementation and quality of technical scope	B.S. Geology, 10 years environmental experience, Professional Geologist
Eric Watt	FOL, SSO, RLSC	TtNUS	Supervises, coordinates, and performs field sampling activities. Coordinates with OASQA to procure laboratory services. Oversees well drilling and installation.	B.S. Geology, 7 years environmental experience.
Megan Ritchie	QAM	TtNUS	Reviews SAP. Ensure Quality aspects of the RAC 2 program.	B.S. Biology/Environmental Studies, 13 years environmental experience
TBD	TBD	Drilling Subcontractor	Installation of additional borings, packer testing and well installation	PA Licensed Well Driller
TBD	TBD	Geophysics Subcontractor	Conduct borehole geophysics on newly installed borings	PA Professional Geologist
Cheryl Scanlon	HSO	TtNUS	Health and Safety	B.S. Wildlife Science, Certified Safety Professional, 19 years environmental experience.

PROJECT ORGANIZATION AND RESPONSIBILITY

The USEPA maintains overall responsibility for the project. The USEPA RPM directs the effort of all USEPA and contractor personnel related to the site. The majority of work at the site will be performed by contractor personnel under a Work Assignment to TtNUS. The project organization described below identifies the site-specific responsibilities of the project personnel as relates to the efficient identification of and implementation of quality assurance objectives and requirements, and to facilitate the resolution of any quality assurance problems at the Lower Darby Creek Area (LDCA) - Clearview Landfill site.

TtNUS Program Manager

The responsibilities of the Program Manager under this SAP include:

- All work performed under this SAP is in compliance with USEPA Scope of Services for the project.
- Program budget proposals include provisions to comply with environmental protection requirements and taking appropriate management actions to include sufficient environmental resources for assigned functions in budget proposals.
- Appropriate environmental requirements are included in program plans.
- Sufficient staff and resources are available to complete project work and deliverables within established schedule.
- Activities performed by TtNUS personnel meet identified project goals.

TtNUS Site Manager / Project Manager

The responsibilities of the TtNUS Site Manager include:

- Reviewing the SAP to ensure that all quality assurance (QA) work elements comply with all applicable USEPA standard operating procedures (SOPs),
- Reviewing other project plans to ensure their compliance with the SAP,
- Conducting or arranging for the performance of QA assessment and auditing activities, and ensuring that out-of-compliance issues are resolved in accordance with this SAP,
- Developing and implementing programs that direct subcontractors to execute investigation activities, and providing for oversight, conformation, and independent verification of those subcontractor programs,
- Reviewing and authorizing release of TtNUS deliverables to USEPA (Note that the Program Manager may perform this function as an alternate to the Site Manager, but only one review will be necessary to meet USEPA's minimum technical requirements),
- Performing a general QA review of USEPA data validation to ensure compliance with specified protocols,
- Maintaining the QA documents in the manner specified in this SAP,
- Abiding by and ensuring that the requirements of this SAP are implemented by site personnel under their authority,
- Ensuring that personnel under their authority attend the training required under this SAP,
- Curtailing or suspending any site operation that poses a clear and present danger to site personnel, members of the public or the environment, and
- Identifying and resolving QA problems and/or deficiencies that may arise on-site in relation to the investigation activities described in this plan.

TtNUS Project Team

The general responsibilities for the project team include:

- Developing, reviewing and understanding this SAP,
- Implementing environmental monitoring activities and QA procedures, such as during sampling activities, according to the provisions of this SAP, and
- Attending the training required by this SAP and following the guidelines and procedures presented in the training.

Subcontractors

Subcontractors performing investigation activities will report directly to the TtNUS Site Manager. Under the SAP, subcontractor responsibilities include:

- Review of environmental requirements and QA procedures specified by this SAP, and
- Implement activities and QA procedures according to the provisions of this SAP.

SAP Worksheet #8 – Special Training Requirements

SPECIAL TRAINING REQUIREMENTS

No special training is required for this project. All personnel assigned to work on the LDCA and Clearview Landfill will be qualified and receive training (40-hour Occupational Health and Safety Administration [OSHA] course) as detailed in Section 3.0 of the RAC 2 Quality Management Plan (QMP).

The work assignment Site Manager is responsible for training of the project team in the QA/QC requirements of the work assignment. This will include familiarizing personnel with this SAP, technical objectives of the project, codes and standards, RAC 2 contract requirements, regulations, and USEPA, administrative and quality control procedures. Specific technical USEPA requirements applicable to this work assignment will also be identified and presented.

SAP Worksheet #9 – Project Scoping Session Participants

Project Scoping Session Participants

Project Name: RI **Projected Date(s) of Sampling: Winter-Summer 2011** **Project Manager: JC Kim**	**Site Name: LDCA Landfill** **Site Location: Philadelphia, Pennsylvania**
Date of Session: August 2, 2010 **Scoping Session Purpose: Discuss upcoming Lower Darby Creek Landfill RI components and scope. Also discussed sampling activities, including installation and sampling of site monitoring wells.**	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Josh Barber	USEPA RPM	USEPA	215-814-3393	Barber.Josh@epamail.epa.gov	Regulator
Mindi Snoparsky	USEPA Hydrogeologist	USEPA	215-814-3316	Snoparsky.Mindi@epamail.epa.gov	Regulatory/ Technical
JC Kim	Engineer	TtNUS	302-283-2235	jc.kim@tetratech.com	Site Manager / PM
Chris Sollenberger	Geologist	TtNUS	302-283-2239	chris.sollenberger@tetratech.com	Technical
Eric Watt	Geologist	TtNUS	302-283-2221	eric.watt@tetratech.com	FOL/SSO/RLSC

Comments/Decisions:

1) Additional bedrock monitoring wells are to be installed to better delineate the lateral and vertical extent of the contaminant of concern (COC) in groundwater; six well pairs, each pair having a shallow screened well and a deeper screened well. Groundwater samples will be collected during the packer testing for volatile organic compound (VOC) analysis to determine the appropriate well construction design. Deep well boreholes will be initially drilled to a depth of aproximately 150 feet. Packer testing and geophysical borehole logging will then be performed. Screen locations for deep and shallow wells will be determined based on VOC sample results of packer testing.

2) All investigation Derived Waste (IDW) is to be containerized onsite for future disposal. No groundwater or drill cuttings are to be discharged/spread on ground surface.

Action Items: Confirm location and conditions of proposed borings/well locations prior to mobilizing to install wells.

SAP Worksheet #10 - Problem Identification

10.1 SITE BACKGROUND

Clearview Landfill is located along the eastern bank of Darby and Cobbs Creeks, at 83rd Street and Buist Avenue (Figure 1).The historical landfill footprint currently resides partly in Delaware County and partly in Philadelphia County, and includes the Clearview Landfill and the City Park east of the landfill.

Clearview Landfill was privately owned and operated without a permit from the 1950s to the 1970s by the Clearview Land Development Corporation, and used for the disposal of municipal and industrial waste collected from the City of Philadelphia and portions of Delaware County. In August 1973, due to several violations of state regulations related to land disposal and the absence of a landfill permit, the Pennsylvania Department of Environmental Protection (PADEP) took court action against the Clearview Land Development Corporation, and ordered it to cease all waste disposal activities at the landfill and follow a prescribed closure plan. However, even after this order, the property continued to be used for other waste disposal operations for many years.

Historical aerial photographs showed that when Clearview Landfill was closed in 1973, the landfill had expanded to the east and covered approximately 65 acres. The wetland areas formerly located east of the landfill were filled. Pools of standing liquid and pits containing liquid (the constituents of the liquid were not determined) were observed on the landfill surface. Tank cars (tanks) and dark stains were also noted on the landfill, indicating that liquid wastes may have been brought to the landfill. The aerial photographs also showed that new residential properties were constructed east and southeast of the landfill, possibly on top of a formerly filled area.

Currently, the southern end of the landfill is used by several businesses, including a waste transfer station, a truck/equipment storing and snow plowing business, an auto repair and salvage operation, and a drum recycling operation. Local residents from the Eastwick neighborhood access the landfill area for walking, all terrain vehicle riding, deer hunting, and other activities. Abandoned cars have also been found at the landfill.

Previous field activities were performed from 2002 through 2006 as part of the current RI. Activities included sediment and surface water sampling in Cobbs and Darby Creeks, upstream and downstream of Clearview Landfill; leachate seep sampling from the bank of Clearview Landfill along Darby Creek; installation of soil borings in City Park and Eastwick neighborhood, and monitoring wells in City Park, followed by soil, soil/landfill gas, and groundwater sample collection; installation of additional soil borings in City Park and Eastwick neighborhood, and permanent vapor monitoring wells in City Park, followed by soil, soil/landfill gas, and groundwater sample collection; collection of earthworm, and sediment and surface water sampling performed in City Park, and Darby and Cobbs Creeks for ecological assessment; installation of soil borings and groundwater monitoring wells in Clearview Landfill, followed by soil, soil/landfill gas, and groundwater sample collection; landfill leachate seep sampling from the banks of Clearview Landfill along Darby Creek; and groundwater sampling from all permanent monitoring wells.

A Screening Level Ecological Risk Assessment (SLERA) was conducted as part of this RI to evaluate potential hazard from chemical concentrations detected in media. The SLERA concluded that risk may exist to lower- and upper-level organisms in the terrestrial, tidal marsh/open water, and non-tidal marsh/open water habitat areas. However, it appeared that there was no unsafe risk through food chain exposure to fish-eating animals from contaminants in tidal riverine surface water; therefore, no bioaccumulation in fish tissue. Since potentially unacceptable risks to ecological receptors were identified during SLERA, the Baseline Ecological Risk Assessment (BERA) was conducted to further evaluate contaminants of potential concern (COPCs) identified during SLERA. As part of the BERA, toxicity tests on surface water, sediment, and soil samples as well as bioaccumulation tests on sediment and surface soil samples were performed.

10.2 THE PROBLEM TO BE ADDRESSED BY PROJECT

Data gaps exist although extensive environmental data (geology, groundwater, surface soil, and surface water) were collected during the initial RI phase of the project (2002-2007). The existing RI data will be used in conjunction with new groundwater data, in support of remediation efforts. Physical and analytical data are needed to determine:

1. If the landfill is impacting the aquifer(s) on the western side of Darby and Cobbs Creeks and beneath the Site.
2. The extent of impacted groundwater to the east of the Site.
3. The discharge point(s) of impacted groundwater from the Site to Darby Creek, Cobbs Creek, or other surface water bodies.

10.3 SCOPE AND OBJECTIVES

The primary objectives of the proposed SAP activities are to collect data of sufficient quantity and quality to better define vertical and lateral extent of contamination at the site and to support future site activities.

Specifically:

- In accordance with a scoping meeting held with USEPA on August 2, 2010, install 12 additional monitoring wells (six well pairs) to delineate the lateral and vertical extent of the site groundwater contamination. Each well pair will consist of a bedrock screened well (well identification with suffix “D”) and a shallow aquifer screened well (well identification with suffix “S”). Packer testing of discrete zones within two deeper drilling boreholes will be performed to aid in determination of the final screened intervals for each of the well. Groundwater samples will be collected from each of the packer testing zones and analyzed for VOCs analysis. Groundwater from the monitoring wells will be analyzed for TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane analyses. Figure 2 depicts the locations of the new wells to be installed.

- Groundwater quality data will be collected from 15 existing groundwater monitoring wells (wells MW-01S/D, MW-02, MW-03, MW-04, MW-05S/D, MW-06, MW-07S/D, MW-08, MW-09, MW-10, MW-11, and MW-12) and the 12 new wells (wells MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D). The purpose of the sampling effort is to obtain water quality data to better define the site groundwater contamination, and to confirm the extent of the contamination. Figure 2 depicts the locations of the 27 groundwater monitoring well locations to be sampled. Groundwater samples will be analyzed for TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane.

- Two pump tests will be performed in the future as a separate effort, to determine the aquifer characteristics, primarily the hydraulic conductivity, transmissivity, and storativity of the aquifer. Pump tests will be conducted by extracting water at a known rate for a specified period of time, and monitoring the changes in water level in the pumping well and other nearby monitoring wells. Two pump tests will be performed for 8 to 12 hours. Figure 3 indicates the groundwater flow direction at the site.

- A Phase 1A cultural resources survey will be performed to determine if historic cultural resources are present on or around the Clearview Landfill, and to ensure clean-up activities at the Site are compliant with Section 106 of NHPA (36 CFR Part 800). The potential cultural resources may include, but are not limited to, a revolutionary war soldier graveyard and an Underground Railroad slave tunnel. The Phase 1A survey will identify documented cultural resources and areas of cultural sensitivity in the project area. The survey will consist of a broad-based literature search utilizing guidance provided by the State Historic Preservation Officer (SHPO) and include public archives, libraries, historical and archaeological societies, and court records among others. A work plan for this task is available under separate cover.

Observations from any site reconnaissance reports: NA

The possible classes of contaminants and the affected matrices:

Groundwater: VOCs, semivolatile organic compounds (SVOCs), Pesticides, Polychlorinated Biphenyls (PCBs), total and dissolved Target Analyte List (TAL) metals including mercury and cyanide.

The rationale for inclusion of chemical and non-chemical analyses:

The site groundwater COCs include tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride. Groundwater samples will be collected from discrete packer testing zones during monitoring well installation, and will be analyzed for VOCs to aid in determination of final well screen locations. Well screens will be located within water bearing zones having elevated contaminant concentrations.

Groundwater at the site has not been sampled for pertinent water quality parameters since 2007. In addition, more extensive plume delineation is needed in order to effectively design a remedy for the site and for future bioremediation efforts. Site-wide groundwater sampling will be performed for the following analyses: Target Compound List (TCL) Organics, TAL Inorganics (total and dissolved), , dioxins and furans, and 1,4-dioxane. In addition, basic field measured parameters, such as pH, temperature, oxidation/reduction potential (ORP), dissolved oxygen (DO), conductivity, and turbidity, will also be measured, as will water levels.

Project decision rules (If..., then... statements):

1. If water bearing fracture zones containing elevated levels of contaminants are encountered during packer testing of discrete zones within the deep well boreholes, then these zones will be selected for monitoring well screen locations. Screen locations will be reviewed with USEPA prior to installation.

2. If monitoring well sampling data satisfy data quality objectives, then the data will be used to further delineate the horizontal and vertical extent of the site groundwater contamination plume.

*Site maps and figures detailing the site location, boundaries, and sampling locations are included in Appendix B of this SAP.

SAP Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objectives (DQOs)

Steps 1 (Problem Definition) and 2 (Study Goals) of the DQO process are presented in Worksheet #10 Section 10.2.

Step 3 - Input Required to Make the Decisions

Data and information that will be required to make decisions about site groundwater include the following:

Borehole Screening Sampling

1. Chemical Data
   Concentrations of TCL Volatile Organics in groundwater during borehole packer testing will be determined by a fixed-based analytical laboratory with an expedited turnaround time (TAT).

   There are no Project Screening Levels (PSLs) for the borehole screening samples. The levels of contaminant concentrations encountered during packer testing will be used to determine final monitoring well screen locations only.

Groundwater Sampling

1. Field Parameters
   Field measurements of pH, specific conductivity, turbidity, DO, temperature, and ORP in groundwater will be collected as part of the low-flow purging and sampling procedure to ensure the parameter stability and representativeness of the groundwater that is collected during this sampling event.

2. Chemical Data
   Concentrations of TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane, in groundwater during monitoring well sampling will be determined by a fixed-based analytical laboratory. Ferric/ferrous iron will be analyzed in the field using a field test kit. These data will be used as a basis to perform groundwater remediation activities.

3. PSLs
   Contaminant concentrations in groundwater will be compared to the Region III Regional Screening Levels (RSLs) for tapwater.

Step 4 – Decision Boundaries

The horizontal boundary to delineate the extent of the contaminated groundwater plume will be groundwater west of Darby Creek, just north of Cobbs Creek, and east of Buist Avenue in the residential area of the site. The vertical boundary of the groundwater will be determined in the field using packer testing and borehole geophysics. Proposed locations of new wells (2 wells at six locations, for a total of 12 wells) are depicted on Figure 1 in Appendix B, but are subject to adjustment in the field based on field conditions. Alternative well locations are also depicted on Figure 1.

Groundwater quality data will be collected from 15 existing groundwater monitoring wells (wells MW-01S/D, MW-02, MW-03, MW-04, MW-05S/D, MW-06, MW-07S/D, MW-08, MW-09, MW-10, MW-11, and MW-12) and the 12 new wells (wells MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D). The purpose of the sampling effort is to better delineate the vertical and lateral extent of contamination plume for future remediation efforts. Figure 1 depicts the locations of the 27 groundwater monitoring wells to be sampled.

Step 5 – Decision Rules

Project decision rules were presented in Worksheet #10.

Step 6 – Limits on Decision Errors

Probability limits for false positive and false negative decision errors were not established. Simple comparisons of measured concentrations to project screening levels and historical data will be used. In order to limit uncertainty in the field and laboratory data, performance criteria for field collection and laboratory analysis will be measured. Performance criteria are described in Worksheets #12, 15, and 28.

Step 7 – Sampling Design

The sampling design is presented in Worksheet #17.

Who will use the data?
USEPA and Tetra Tech will be the primary users of data generated during the RI.

What will the data be used for?
Data will be used to:

1) Assess the current vertical and horizontal distribution of COCs in groundwater.
2) Assess the horizontal distribution of site COCs in groundwater in areas not previously characterized to fill existing data gaps.
3) Identify potential fractures and preferential flow pathways.
4) Determine the aquifer characteristics, primarily the hydraulic conductivity, transmissivity, and storativity.
5) Evaluate groundwater flow directions and rates by generating potentiometric maps.

What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

Matrix: Groundwater

A fixed-based Contract Laboratory Program (CLP) laboratory will be used to analyze groundwater samples. All groundwater samples will be analyzed for TCL Organics, TAL Inorganics (total and dissolved), natural attenuation parameters, hexavalent chromium, dioxins and furans, PCB congeners, and 1,4-dioxane. Field measurement parameters for groundwater samples (does not apply to packer testing samples) include pH, specific conductivity, turbidity, DO, temperature, and ORP. Groundwater level measurements will be performed in the field at all site monitoring wells.

How "good" do the data need to be in order to support the environmental decision?
The screening data generated during the discrete interval packer testing will receive zero level (ZL) data validation. The analytical data for the samples collected during borehole packer testing and sampling are intended to be used solely for screening purposes to evaluate the sample locations for construction design of the monitoring wells.

All analytical data from the monitoring wells require full validation. TCL Organics, dioxins and furans, PCB congeners, and 1,4-dioxane require USEPA Level M3 (organic criteria) validation. TAL Inorganics (total and dissolved), natural attenuation parameters, hexavalent chromium, require USEPA Level IM2 (inorganic criteria) validation.

The CLP laboratory must hold a current USEPA CLP accreditation and comply with the requirements of CLP Statement of Work (SOW) SOM01.2, SOW ISM01.2 for QA/QC and for reporting analytical results.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

Packer Testing Data
Screening Data - Six deep bedrock borings will be installed as part of the RI well installation. It is expected that up to three grab groundwater samples will be collected from the first two of six borings during the borehole packer testing (total of 6 samples). The number of samples does not include QC samples.

Monitoring Well Data
Groundwater samples will be collected from each of the 12 new monitoring wells and 15 existing site monitoring wells (total of 27 samples) and submitted for analyses for TCL Organics, TAL Inorganics (total and dissolved), natural attenuation parameters, hexavalent chromium, dioxins and furans, PCB congeners, and 1,4-dioxane. The number of samples does not include QC samples.

Where, when, and how should the data be collected/generated?

Packer Testing/Borehole Sampling
Borehole groundwater samples will be collected from the site on a one-time basis for laboratory screening analysis. The samples for packer testing will be collected by TtNUS using techniques presented in SOP GH-1.5. The data will be generated at a CLP laboratory upon receipt of the groundwater samples generated from the site. Proposed boring/well locations are depicted on Figure 1 in **Appendix B**. See Worksheet #18.

Monitoring Well Sampling
Two rounds of groundwater sampling of new and existing monitoring wells will be conducted in accordance with USEPA Low-Flow Sampling protocols (Region III QAD023). TtNUS will relinquish custody of the samples to the laboratory after collection, packaging, and shipping. Proposed boring/well locations are depicted on Figure 1 in **Appendix B**. See Worksheet #18.

SAP Worksheet #12 – Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Trip Blank	VOC	1 per cooler containing VOC samples	Bias / Contamination	No target compounds > Contract Required Quantitation Limit (CRQL) (except common laboratory contaminants which should be <2XCRQL)	S&A
Field Blank	VOC, SVOC, Pesticides, PCBs, PCB congeners, Metals, Dioxins/Furans, 1,4-Dioxane	1 per 20 environmental samples	Bias / Contamination	No target compounds >CRQL (except common laboratory contaminants which should be <2XCRQL)	S&A
Rinsate Blank	VOC, SVOC, Pesticides, PCBs, PCB congeners, Metals, Dioxins/Furans, 1,4-Dioxane	1 per 20 environmental samples per sampling equipment set	Bias / Contamination	No target compounds >CRQL (except common laboratory contaminants which should be <2XCRQL)	S&A
Filtered Rinsate Blank	Metals	1 per 20 environmental samples per sampling equipment set	Bias / Contamination	No target compounds >CRQL (except common laboratory contaminants which should be <2XCRQL)	S&A
Field Duplicate	VOC, SVOC, Pesticides, PCBs, PCB congeners, Metals, Dioxins/Furans, 1,4-Dioxane	1 per 10 environmental samples	Precision / Comparability	Water Samples Values > 5X CRQL: ±30 Relative Percent Difference (RPD) Values < 5X CRQL: absolute difference between the two samples must be ≤CRQL	S&A
Matrix Spike/Laboratory Duplicate	VOC, SVOC, Pesticides, PCBs, PCB congeners, Metals, Dioxins/Furans, 1,4-Dioxane	1 per 20 environmental samples	Precision / Accuracy	Organics: Statistically determined by the laboratory. Inorganics: 75 – 125% Recovery (%R), RPD ≤ 20%	S&A

Note: MPCs for Laboratory QC samples are located in Worksheet 28. Explanations of DQIs are located in Worksheet 37. No field QC samples will be collected for the natural attenuation parameters.

Submission of Quality Control Samples

To establish the precision, accuracy, and representativeness of data obtained from the sampling effort, QC samples will be submitted to the laboratories for chemical analysis. The QC samples include field duplicates (blind duplicates), matrix spikes/matrix spike duplicates (MS/MSDs), field blanks, equipment rinseate blanks, and trip blanks.

- Field Duplicate Samples: Duplicate samples will be collected and analyzed to provide a means of evaluating the relative precision of the sample collection procedure. An important factor in evaluating analytical data from sample pairs is the homogeneity of the analyte within the sample matrix. Duplicate samples are multiple samples, collected simultaneously, that equally represent a medium at a given time and location. They are submitted to the laboratory as separate samples and are not identified as duplicates. The matrix and the duplicate water samples will be collected by first filling the matrix sample bottle and then the replicate sample bottle. .

  Duplicate samples will be collected from each media of concern as specified in Worksheets 18 and 20 of this SAP. The actual locations proposed for duplicate collection will based on field conditions encountered. Wherever possible, duplicate samples will be collected from critical data locations.

- Field Blank: Field blanks are generated in the field by collecting analyte-free water into a clean sample container. The purpose of the field blank is to evaluate ambient field conditions and the cleanliness of sample containers, which may be a means of introducing contaminants into the collected samples.

- Equipment Rinsate Blank: Equipment rinsate blank samples will be collected and analyzed to test for potential contamination from sampling instruments used to collect and transfer samples from the point of collection into sample containers. Equipment rinsate blanks are required when dedicated sampling tools are not used. Equipment rinsate blanks are generated by passing analyte-free water through sampling equipment after it has been decontaminated between uses. The filtered rinsate blank will be collected by passing analyte-free water through a clean filter. The purpose of rinsate blanks is to evaluate equipment decontamination procedures and to determine whether the sampling equipment could cross-contaminate samples.

- Trip Blank: The primary purpose of a trip blank is to detect sources of VOC contamination that may influence laboratory results of site-related samples. Trip blanks will be poured in the field using analyte-free water prior to the collection of site-related samples. Trip blanks will accompany the volatile organic compound sample containers throughout the entire sampling process, from the initial preparation through sampling activities and shipment to the laboratory. One trip blank will be placed in each shipping cooler that contains samples for volatile organics analysis. Since trip blanks will be collected in the field, no field blanks will be submitted with the samples.

SAP Worksheet #13 - Secondary Data Criteria and Limitations Table

☐ Worksheet Not Applicable (State Reason)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
RI/FS Report	Tetra Tech NUS, Inc. LDCA Site, Remedial investigation/Feasibility Study (RI/FS) Report, September 2009	Tetra Tech, Inc. Full TCL and TAL analyses of all media, including soil, sediment, surface water, soil gas, and groundwater.	Historical data will be compared to new data in order to evaluate current groundwater conditions. Historical data in combination with new data will be used to design the groundwater remediation.	Data were fully validated and used for risk assessment during the RI/FS. All data from the RI will be used with the exception of data qualified as unusable (R) or qualified due to blank contamination (B).

SAP Worksheet #14 – Summary of Project Tasks

Summary of Project Tasks

Field activities will include the following tasks:

- Mobilization and demobilization
- Groundwater monitoring well Installation (6 shallow/deep bedrock well couplets; total of 12 wells), including borehole packer testing and geophysical testing of up to 2 deep bedrock borings
- Groundwater sampling of discrete packer test zones
- Groundwater sampling of 27 site wells (12 new wells and 15 existing wells)
- IDW Management

See Appendix B Figure 1 for location of site and location of sampling and field measurement locations.

14.1 MOBILIZATION AND DEMOBILIZATION

This task involves preparing for the field activities and demobilizing from the site upon their completion. Tetra Tech will identify the necessary field support equipment, supplies and facilities, to mobilize to the site to perform sampling activities. Site mobilization will consist of preparation for field activities and includes, but is not limited to, the following activities:

- Perform all required training and orientation.
- Obtain all equipment required to perform field activities.
- Identify and prepare locations for all field activities.
- Coordinate sample types, analyses, and sampling schedule with Region III OASQA and CLP.

As part of demobilization, equipment and supplies will be collected, inventoried, and returned as appropriate. All field investigation paperwork will be filed and incorporated in the project record.

Tetra Tech will prepare a list of all equipment and supplies necessary for the field team to perform field activities. This list includes but is not limited to:

- All documents, forms, logbooks, log sheets, labels, custody seals, air bills, and other paperwork required by the SAP and Health and Safety Plan (HASP).
- Vehicles for personnel, equipment, and sample transport.
- Personnel and equipment decontamination supplies and equipment required by the SAP and HASP.
- Media sampling field analytical equipment and calibration standards for all required parameters of the SAP.
- All required sample containers.
- Equipment and supplies for sample custody, preservation, and packaging.
- Other miscellaneous office and field supplies.

During the required training and orientation, all field team members will review the SAP and will be given site-specific health and safety training based on the HASP. A field team orientation meeting will be held to familiarize personnel with the scope of the field activities. The orientation will include a walking tour of the site and a drive around the main roads of the area to familiarize personnel with the physical layout of the site and adjacent off-site areas.

The field team will obtain the required equipment and supplies from the Tetra Tech warehouse or offices and transport it to and stage it at the base of operations. Any equipment not available at the Tetra Tech warehouse or offices will be purchased or rented by Tetra Tech. Equipment will be calibrated as required by the SAP and HASP on an as-needed basis.

Site demobilization will consist of removing from the site all facilities, supplies, and equipment no longer needed at the end of field work. The base of operations and field work locations will be restored as closely as possible to their original conditions by the field team or the responsible subcontractor.

14.2 SAMPLE HANDLING

Sample handling includes such field-related considerations as the selection of sample containers, preservatives, allowable holding times, and the analysis requested. Worksheet 19 addresses the topic of containers and sample preservation.

The proposed number of samples, including QC samples, sample media, and analyses are detailed in Worksheets #17 and #18. Sample containers, preservation requirements, and holding times are summarized in Worksheet #19.

Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with the USEPA Introduction to the Contract Laboratory Program (January 2007), the USEPA CLP Guidance for Field Samplers (May 2010). The FOL will be responsible for contacting the Sample Management Office (SMO) for each shipment and will report the following:

- Sampler name and telephone number
- Case number and/or DAS number of the project
- Site name and code
- Number(s), matrix(ces), and concentration(s) of samples shipped
- Laboratory(ies) to which samples were shipped
- Carrier name and air bill number(s) for the shipment
- Method of shipment (e.g., overnight or 2-day shipment)
- Date of shipment
- Suspected hazards associated with the samples or site

Documentation

Custody of the samples will be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. TtNUS SOP SA-6.3 (included in Appendix A) provides a description of the chain-of-custody procedures to be followed. The chain-of-custody reports will be generated by computer using the most current version of the USEPA Forms II Lite software, procedures, and protocol.

In addition to the USEPA-required CLP documentation (e.g., chain-of-custody/traffic reports) and QC of samples, certain standard forms will be completed for sample description and documentation. These will include the sample log sheet (for groundwater samples) and project sample shipping logs. Examples of these forms can be found in TtNUS SOP SA-6.3. The type of preservative(s) used for each sample will be noted on the sample log sheet. The source of the preservatives and any other reagents will be documented in the site logbook.

A bound, weatherproof field notebook will be maintained for field activities by the FOL and SSO. The FOL or his/her designee will record all information related to sampling or field activities. This information will include sampling time, weather conditions, unusual events, field measurements, description of photographs, etc.

The calibration of monitoring, measuring, or test equipment is necessary to ensure the proper operation and response of equipment, to document the accuracy, sensitivity, or precision of the measurements, and to determine if correction should be applied to the readings. Each instrument requiring calibration will have its own equipment calibration log documenting the calibration of the equipment including the frequency and type of standard or calibration procedure.

At the completion of field activities, the FOL will submit to the project manager all field records, data, field notebooks, logbooks, chain-of-custody receipts, sample log sheets, drilling logs, daily logs, etc. The project manager will ensure that these materials are entered into the RAC program document control system in accordance with administrative guidelines.

14.3 MONITORING WELLS

Monitoring Well Locations

A network of 27 monitoring wells will be sampled at the Lower Darby Creek site during RI activities. Fifteen of the wells are existing wells and 12 are new wells yet to be installed. Locations of these wells are depicted on Figure 1 in Appendix B. A listing of the wells follows:

- Existing Wells: MW-01S/D, MW-02, MW-03, MW-04, MW-05S/D, MW-06, MW-07S/D, MW-08, MW-09, MW-10, MW-11, and MW-12
- New Wells: MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D

The "S" designation denotes a shallow well, and the "D" designation denotes a deep well.

After construction of the new wells, they will be surveyed for location and casing elevations. After construction of the new wells, and prior to monitoring, a table will be prepared providing the following:

- Well designation
- Casing diameter
- Top of inner casing elevation
- Well depth
- Screen setting

This monitoring well as-built table (including the wells previously installed as part of the RI) will be provided to the sampling crews.

Monitoring Well Construction

Six new bedrock/overburden monitoring well pairs (total of 12 wells) will be installed at the site. The well pairs will consist of shallow and deep screened wells. The wells will be designated as MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D (S=Shallow, D=Deep). Based on a review of existing wells at the site, the estimated well construction details are as follows:

Well	No. of Wells	6" Overburden Casing (feet)	Screen Depth Range (feet below ground surface [ft bgs])	Maximum Estimated Total Depth of Boring (ft bgs)
Shallow Bedrock	6	NA	20 to 50	50
Deep Bedrock	6	20 to 50	120 to 150	150

All wells shall be installed in accordance with American Society for Testing and Materials (ASTM) D5092-90 (Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers) and in accordance with applicable TtNUS SOPs. Well drilling will be conducted using air rotary drilling techniques. For the deep wells, a 10-inch borehole will initially be advanced through the overburden and set into at least 2 feet of competent bedrock. A 6-inch protective carbon steel casing will then be installed in the borehole and grouted in place and allowed to cure 24 hours before proceeding with drilling. A 6-inch borehole will then be advanced through the

steel casing to an approximate depth of 150 feet. The maximum depth of boring was estimated based on drilling to an assumed depth of 50 feet below competent rock. Should water not be encountered within 50 feet of the upper confident rock, the boring will be considered a dry hole. During drilling, cuttings will be sampled and logged at 5-feet intervals to characterize the subsurface conditions encountered. Other pertinent observations (rate of penetration, water yields, etc.) will be noted as appropriate to characterize the subsurface conditions encountered. All drill cuttings and wash water will be contained, characterized, and disposed of appropriately, as further discussed in Section 14.5.

After completion of the initial deep boring at each paired well location, aquifer hydrogeologic property analyses (such as borehole geophysical logging and packer tests) will be conducted to identify the fractures that contain the most contamination for subsequent screened interval selection. Once the screened interval determination has been made, all permanent deep wells (4-inch PVC casing with a 0.020 slotted screen) will be constructed. A 10-foot screen interval is proposed for each well; however, final screen interval will be determined based on bedrock fractures encountered and packer testing results. The wells will be completed by installing a filter pack to a level at least 2 feet above the top of the screen, followed by a 3-foot bentonite seal and pressure grouting to the appropriate depth. After installation, each new deep well will be developed and surveyed. After the deep well at each location has been completed, a shallow well will be constructed similarly in the overburden to monitor vertical migration of groundwater. The depth of the shallow well will be determined by the drilling performed during the construction of the deep well. Each shallow well will be constructed using air rotary methods. A 6-inch boring will be advanced to the top of the bedrock, after which a 4-inch temporary casing will be advanced. The 2-inch PVC wells will be constructed within the 4-inch casing with approximately 10 feet of screen. A filter pack will be installed to at least I foot above the top of screen, followed by a 2-foot bentonite seal and pressure grouting to the appropriate depth.

Well Finishing

The wells shall be completed as standard, stick-up wells or flush mount, depending on well locations. For stick-up wells, the height of the stick-up shall be not less than 3 feet or more than 4 feet. A minimum 3 ft x 3 ft 12-inch thick reinforced (3 - #4, spaced equally, each way, top and bottom) concrete apron (3,000 psi rating) shall be poured around each standpipe. (Note: the use of leftover bentonite/cement grout to construct the apron is not acceptable and is prohibited.) Each concrete apron shall be sloped to promote drainage away from the well. The steel casings shall have a removable and lockable steel lid with non-corroding brass or bronze locks. Weep holes shall be installed in the standpipes just above the aprons. The PVC casings shall have a removable water-tight pressure cap. The well cap shall be Brainard-Kilman TC-102 or approved equal. All protective well casings and covers shall be painted with ultraviolet light resistant paint – Color: high visibility yellow. The unit price for surface completion of stick-up wells shall include stick-up casing, caps, lock and reinforced concrete pad.

For flush-mount wells, a cap will be installed on the top of the well, and set in a concrete pad approximately 2 ft x 2 ft x 0.5 ft. The pad should be slightly elevated at the cap, and slope away from the well to prevent surface water from running into the well. The unit price for surface completion of flush-mount wells shall include galvanized steel casing, cast iron flange, cast iron cap with rubber gasket bolted to flange, and reinforced concrete pad.

Well Development

All new wells will be developed after installation using a submersible pump. Either airlift/surging or surge block technique procedures may be used to develop monitoring wells. The wells shall be developed until the discharge water is relatively free of sand or other fine material as determined by the Tetra Tech geologist. Groundwater from well development will be collected and pretreated as described later in this section (Investigation Derived Waste).

Cleanup and Restoration of Well Locations

All reasonable efforts need to be made to minimize the amount of soil and mud deposited on public and private roadways by well installation equipment. The removal of gross accumulations of soil or mud from vehicles before leaving the work locations, and shoveling or sweeping accumulations of soil or mud from roadways may be required. At the conclusion of the work at each boring location, all equipment, tools, material, and supplies, and will be removed and the site will be clean and clear of all debris generated by field activities. The site will be restored as nearly as practical to its condition before the commencement of the work provided for herein. All structures or property damaged will be restored as nearly as possible to their original condition.

Groundwater Sampling and Analysis

Packer Testing Sampling

Grab groundwater samples will be collected during packer testing of discrete fracture zones during drilling of the deep borehole during monitoring well installation activities. Up to 3 samples will be collected from two of the six deep borings (typically one sample per discrete zone that is packer tested). Expedited turn-around time (48 hours for preliminary data) for TCL Volatile Organic Compounds will be requested in order to expedite the drilling process and to minimize any down time. The sampling and analysis program is outlined in Worksheet #18, and the sampling requirements for each type of analyses (i.e., bottleware, preservation, holding time) are listed in Worksheet #19. QC samples will be obtained at frequencies specified in Worksheet #20.

Monitoring Well Sampling

Two groundwater sampling and analysis events will be performed at the Clearview Landfill site. A network of 27 monitoring wells (existing at 18 locations) will be sampled at the site during RI activities. Fifteen of the wells are existing wells and 12 are new wells yet to be installed. Locations of these wells are depicted on Figure 1 in Appendix B. A listing of the wells follows:

- Existing Wells: MW-01S/D, MW-02, MW-03, MW-04, MW-05S/D, MW-06, MW-07S/D, MW-08, MW-09, MW-10, MW-11, and MW-12
- New Wells: MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D

The “S” designation denotes a shallow well, and the “D” designation denotes a deep well. The sampling and analysis program is outlined in Worksheet #18, and the sampling requirements for each type of analyses (i.e., bottleware, preservation, and holding time) are listed in Worksheet #19. QC samples including trip blanks, rinse blanks, blind duplicates, and MS/MSD samples will be obtained at frequencies specified in Worksheet #20. Well sampling procedures are discussed in SOP SA-1.1, which is included in Appendix A.

Water-level measurements will be collected from all site monitoring. The water levels will be measured prior to the start of the well sampling task, and all measurements will be collected within an 8-hour period of consistent weather conditions to minimize atmospheric or precipitation effects. The water levels will also be obtained a minimum of 12 to 24 hours after a significant rainfall event in order to negate the effects of short-term fluctuations in hydraulic head.

All monitoring wells will be sampled using the low-flow sampling techniques in accordance with the USEPA Region 3 Recommended Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells, Bulletin No. QAD023, June 16, 1999. All monitoring wells will be purged/sampled using a properly decontaminated stainless steel submersible pump (or other approved method) equipped with polyethylene tubing. The tubing will be dedicated to the monitoring well upon sample completion. The pump(s) utilized for the project will be able to accommodate 2-inch wells and capable of performing the low-flow sampling technique. Purge water may be discharged directly to the ground.

Groundwater samples will be analyzed for TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane.

The field parameters, temperature, pH, specific conductance, DO, and ORP shall be measured and recorded at 5-minute intervals during the purging process until field parameter stabilization and sampling. Field parameter stabilization is defined in the USEPA low flow methodology. Tetra Tech SOP SA-1.1 (Appendix A) also presents procedures for measuring field parameters.

A brief outline of the schedule of drilling and sampling activities is listed below:

- Install two deep borings at selected locations
- Perform packer testing to determine yield of bedrock fractures and collect samples for VOC analysis
- Resume installation of borings; followed by construction of monitoring wells, with screened intervals located in deep borings based on packer testing results.
- Develop newly installed monitoring wells after construction is complete
- Sample existing and new monitoring wells at least 10 days after development is complete.

Sampling equipment shall be decontaminated in accordance with the USEPA low flow sampling procedure.

14.4 EQUIPMENT DECONTAMINATION

Equipment decontamination procedures are discussed in SOP SA-7.1, included in Appendix A.

Drilling Equipment

All downhole drilling equipment will be steam cleaned before work is begun, between the drilling of separate boreholes, any time the drilling rig leaves the drill site before a boring is completed, and at the conclusion of the drilling program. Decontamination operations will consist of washing equipment using a high-pressure steam wash. All decontamination activities will take place at a designated low lying area on the landfill. Decontamination-generated fluids will need to be collected and containerized.

Sampling Equipment

Equipment decontamination procedures are discussed in SOP SA-7.1 (included in Appendix A). All sampling equipment used for collecting samples will be decontaminated both before sampling in the field and between sample locations. The following decontamination steps will be followed:

- Potable water rinse
- Alconox or Liquinox detergent wash
- Potable water rinse
- Distilled/deionized water rinse
- Ethanol rinse
- Distilled/deionized water rinse
- Air dry
- Wrap in aluminum foil if not used immediately

14.5 INVESTIGATION DERIVED WASTE

The following IDW is anticipated during the RI activities:

- Drill cuttings during bore-hole drilling of new monitoring wells.
- Water during borehole drilling, packer testing, and well construction and development.
- Sampling equipment decontamination water.
- General trash: All used personnel protective clothing and disposable equipment.

It is assumed that all drill cuttings, groundwater generated during drilling, development, packer testing, pump testing, and equipment decontamination will be collected and/or containerized, characterized, and disposed of as appropriate. To manage IDW under this assumption, a frac tank and a roll-off dumpster are required. General trash including all used personnel protective clothing and disposable equipment, as well as general trash will be disposed as ordinary waste. No drill cuttings shall be left at the boring/well locations upon completion of construction. Groundwater generated during these activities could be discharged to the sewer line with/without pretreatment. However, this option is subject to water quality and approval by the local water authority.

14.6 SAMPLING DESIGNATIONS

The sample designation scheme developed for the RI activities is as follows:

SITE NAME - MATRIX - STATION - DEPTH* - DATE *(* packer test samples only)*

SITE NAME: Site name abbreviated as “LDCA".

MATRIX: Matrix abbreviation (GW- groundwater; PT-Packer Test)

STATION: Refers to the alphanumeric sample station (location) identifier.

DEPTH: Will only be used in packer test groundwater samples. A number will be provided in feet below grade.

DATE: Indicates the month, date and year that the sample was collected in the field to act as a discriminator to distinguish the samples from previous or subsequent data. The format is MMYY.

EXAMPLES:

A groundwater sample collected at MW-15D on May 5, 2010 would be identified as LDCA-GW-MW15D-0510.

A groundwater screening sample collected during packer testing of well boring MW-16D at in interval of 100’-110’ on May 5, 2010 would be identified as LDCA-MW16D-PT-100110-0510.

No dash is used in the station designation, and zero is used as a place holder for locations numbered 1 through 9.

14.7 SAMPLING SUMMARY

The table below provides a summary of required samples and field measurements at the LDCA site.

FEATURE	MATRIX	NUMBER OF FIELD SAMPLES	PARAMETER	FIELD MEASUREMENTS
Deep Monitoring Well Boreholes (2 out of 6)	Groundwater	Dependent on field conditions, up to 3 samples per borehole, for a total of 6	TCL VOCs	DO, pH, ORP, conductivity, turbidity, and temperature
Monitoring Wells	Groundwater	27	TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane	DO, pH, ORP, conductivity, turbidity, and temperature, groundwater level

SAP Worksheet #15 – Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: Trace VOC

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Dichlorodifluoromethane	75-71-8	3.9E+02	3.9E+02	TBD	0.5
Chloromethane	74-87-3	1.9E+02	1.9E+02	TBD	0.5
Vinyl chloride	75-01-4	1.6E-02	1.6E-02	TBD	0.016
Bromomethane	74-83-9	8.7E+00	8.7E+00	TBD	0.5
Chloroethane	75-00-3	2.1E+04	2.1E+04	TBD	0.5
Trichlorofluoromethane	75-69-4	1.3E+03	1.3E+03	TBD	0.5
1,1-Dichloroethene	75-35-4	3.4E+02	3.4E+02	TBD	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5.9E+04	5.9E+04	TBD	0.5
Acetone	67-64-1	2.2E+04	2.2E+04	TBD	5.0
Carbon disulfide	75-15-0	1.0E+03	1.0E+03	TBD	0.5
Methyl acetate	79-20-9	3.7E+04	3.7E+04	TBD	0.5
Methylene chloride	75-09-2	4.8E+00	4.8E+00	TBD	0.5
trans-1,2-Dichloroethene	156-60-5	1.1E+02	1.1E+02	TBD	0.5
Methyl tert-butyl ether	1634-04-4	1.2E+01	1.2E+01	TBD	0.5
1,1-Dichloroethane	75-34-3	2.4E+00	2.4E+00	TBD	0.5
cis-1,2-Dichloroethene	156-59-2	3.7E+02	3.7E+02	TBD	0.5
2-Butanone	78-93-3	7.1E+03	7.1E+03	TBD	5.0
Bromochloromethane	74-97-5	NA	0.5	TBD	0.5
Chloroform	67-66-3	1.9E-01	1.9E-01	TBD	0.19
1,1,1-Trichloroethane	71-55-6	9.1E+03	9.1E+03	TBD	0.5
Cyclohexane	110-82-7	1.3E+04	1.3E+04	TBD	0.5
Carbon tetrachloride	56-23-5	4.4E-01	4.4E-01	TBD	0.44
Benzene	71-43-2	4.1E-01	4.1E-01	TBD	0.41
1,2-Dichloroethane	107-06-2	1.5E-01	1.5E-01	TBD	0.0.15
Trichloroethene	79-01-6	2.0E+00	2.0E+00	TBD	0.5
1,4-Dioxane	123-91-1	NA	20	TBD	0.67
Methylcyclohexane	108-87-2	NA	0.5	TBD	0.5
1,2-Dichloropropane	78-87-5	3.9E-01	3.9E-01	TBD	0..9

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Bromodichloromethane	75-27-4	1.2E-01	1.2E-01	TBD	0.12
cis-1,3-Dichloropropene	10061-01-5	NA	0.5	TBD	0.5
4-Methyl-2-pentanone	108-10-1	2.0E+03	2.0E+03	TBD	5.0
Toluene	108-88-3	2.3E+03	2.3E+03	TBD	0.5
trans-1,3-Dichloropropene	10061-02-6	NA	0.5	TBD	0.5
1,1,2-Trichloroethane	79-00-5	2.4E-01	2.4E-01	TBD	0.24
Tetrachloroethene	127-18-4	1.1E-01	1.1E-01	TBD	0.11
2-Hexanone	591-78-6	4.7E+01	4.7E+01	TBD	4.7
Dibromochloromethane	124-48-1	1.5E-01	1.5E-01	TBD	0.15
1,2-Dibromoethane	106-93-4	6.5E-03	6.5E-03	TBD	0.0065
Chlorobenzene	108-90-7	9.1E+01	9.1E+01	TBD	0.5
Ethylbenzene	100-41-4	1.5E+00	1.5E+00	TBD	0.5
o-Xylene	95-47-6	1.2E+03	1.2E+03	TBD	0.5
m,p-Xylene	179601-23-1	2.0E+02	2.0E+02	TBD	0.5
Styrene	100-42-5	1.6E+03	1.6E+03	TBD	0.5
Bromoform	75-25-2	8.5E+00	8.5E+00	TBD	0.5
Isopropylbenzene	98-82-8	6.8E+02	6.8E+02	TBD	0.5
1,1,2,2-Tetrachloroethane	79-34-5	6.7E-02	6.7E-02	TBD	0.067
1,3-Dichlorobenzene	541-73-1	NA	0.5	TBD	0.5
1,4-Dichlorobenzene	106-46-7	4.3E-01	4.3E-01	TBD	0.43
1,2-Dichlorobenzene	95-50-1	3.7E+02	3.7E+02	TBD	0.5
1,2-Dibromo-3-chloropropane	96-12-8	3.2E-04	3.2E-04	TBD	0.00032
1,2,4-Trichlorobenzene	120-82-1	2.3E+00	2.3E+00	TBD	0.5
1,2,3-Trichlorobenzene	87-61-6	2.9E+01	2.9E+01	TBD	0.5

The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

1

Matrix: Groundwater
Analytical Group: TCL SVOC

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Benzaldehyde	100-52-7	3.7E+03	3.7E+03	TBD	5.0
Phenol	108-95-2	1.1E+04	1.1E+04	TBD	5.0
Bis (2-chloroethyl) ether	111-44-4	1.2E-02	1.2E-02	TBD	0.012
2-Chlorophenol	95-57-8	1.8E+02	1.8E+02	TBD	5.0
2-Methylphenol	95-48-7	1.8E+03	1.8E+03	TBD	5.0
2,2'-Oxybis(1-chloropropane)[2]	108-60-1	3.2E-01	3.2E-01	TBD	0.32
Acetophenone	98-86-2	3.7E+03	3.7E+03	TBD	5.0
4-Methylphenol	106-44-5	1.8E+02	1.8E+02	TBD	5.0
N-Nitroso-di-n propylamine	621-64-7	9.6E-03	9.6E-03	TBD	0.0096
Hexachloroethane	67-72-1	4.8E+00	4.8E+00	TBD	4.8
Nitrobenzene	98-95-3	1.2E-01	1.2E-01	TBD	0.12
Isophorone	78-59-1	7.1E+01	7.1E+01	TBD	5.0
2-Nitrophenol	88-75-5	NA	5.0	TBD	5.0
2,4-Dimethylphenol	105-67-9	7.3E+02	7.3E+02	TBD	5.0
Bis(2-chloroethoxy) methane	111-91-1	1.1E+02	1.1E+02	TBD	5.0
2,4-Dichlorophenol	120-83-2	1.1E+02	1.1E+02	TBD	5.0
4-Chloroaniline	106-47-8	3.4E-01	3.4E-01	TBD	0.34
Hexachlorobutadiene	87-68-3	8.6E-01	8.6E-01	TBD	0.86
Caprolactam	105-60-2	1.8E+04	1.8E+04	TBD	5.0
4-Chloro-3-methylphenol	59-50-7	3.7E+03	3.7E+03	TBD	5.0
Hexachlorocyclopentadiene	77-47-4	2.2E+02	2.2E+02	TBD	5.0
2,4,6-Trichlorophenol	88-06-2	6.1E+00	6.1E+00	TBD	5.0
Isophorone	78-59-1	7.1E+01	7.1E+01	TBD	5.0
2,4,5-Trichlorophenol	95-95-4	3.7E+03	3.7E+03	TBD	5.0
1,1'-Biphenyl	92-52-4	1.8E+03	1.8E+03	TBD	5.0
2-Chloronaphthalene	91-58-7	2.9E+03	2.9E+03	TBD	5.0
2-Nitroaniline	88-74-4	3.7E+02	3.7E+02	TBD	10

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Dimethylphthalate	131-11-3	NA	5.0	TBD	5.0
2,6-Dinitrotoluene	606-20-2	3.7E+01	3.7E+01	TBD	5.0
3-Nitroaniline	99-09-2	NA	10	TBD	10
2,4-Dinitrophenol	51-28-5	7.3E+01	7.3E+01	TBD	10
4-Nitrophenol	100-02-7	NA	10	TBD	10
Dibenzofuran	132-64-9	3.7E+01	3.7E+01	TBD	5.0
2,4-Dinitrotoluene	121-14-2	2.2E-01	2.2E-01	TBD	0.22
Diethylphthalate	84-66-2	2.9E+04	2.9E+04	TBD	5.0
4-Chlorophenyl-phenyl ether	7005-72-3	NA	5.0	TBD	5.0
4-Nitroaniline	100-01-6	7.3E+01	7.3E+01	TBD	3.4
4,6-Dinitro-2-methylphenol	534-52-1	2.9E+00	2.9E+00	TBD	2.9
N-Nitrosodiphenylamine	86-30-6	1.4E+01	1.4E+01	TBD	5.0
1,2,4,5-Tetrachlorobenzene	95-94-3	1.1E+01	1.1E+01	TBD	5.0
4-Bromophenyl-phenylether	101-55-3	NA	5.0	TBD	5.0
Hexachlorobenzene	118-74-1	4.2E-02	4.2E-02	TBD	0.042
Atrazine	1912-24-9	2.9E-01	2.9E-01	TBD	0.29
Carbazole	86-74-8	NA	5.0	TBD	5.0
Di-n-butylphthalate	84-74-2	3.7E+03	3.7E+03	TBD	5.0
Butylbenzylphthalate	85-68-7	3.5E+01	3.5E+01	TBD	5.0
3,3'-Dichlorobenzidine	91-94-1	1.5E-01	1.5E-01	TBD	0.15
Bis(2-ethylhexyl) phthalate	117-81-7	4.8E+00	4.8E+00	TBD	4.8
Di-n-octylphthalate	117-84-0	NA	5.0	TBD	5.0
2,3,4,6-Tetrachlorophenol	58-90-2	1.1E+03	1.1E+03	TBD	5.0

[1] The Project Screening Levels are the Region III SLs for Tapwater (May 2010).
[2] Previously known as Bis(2-chloroisopropyl)ether.

1

Matrix: Groundwater
Analytical Group: Polynuclear Aromatic Hydrocarbons (PAHs) by SIM

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Naphthalene	91-20-3	1.4E-01	1.4E-01	TBD	0.10
2-Methylnaphthalene	91-57-6	1.5E+02	1.5E+02	TBD	0.10
Acenaphthylene	208-96-8	NA	0.10	TBD	0.10
Acenaphthene	83-32-9	2.2E+03	2.2E+03	TBD	0.10
Fluorene	86-73-7	1.5E+03	1.5E+03	TBD	0.10
Pentachlorophenol	87-86-5	5.6E-01	5.6E-01	TBD	0.17
Phenanthrene	85-01-8	NA	0.10	TBD	0.10
Anthracene	120-12-7	1.1E+04	1.1E+04	TBD	0.10
Fluoranthene	206-44-0	1.5E+03	1.5E+03	TBD	0.10
Pyrene	129-00-0	1.1E+03	1.1E+03	TBD	0.10
Benzo(a)anthracene	56-55-3	2.9E-02	2.9E-02	TBD	0.029
Chrysene	218-01-9	2.9E+00	2.9E+00	TBD	0.10
Benzo(b)fluoranthene	205-99-2	2.9E-02	2.9E-02	TBD	0.029
Benzo(k)fluoranthene	207-08-9	2.9E-01	2.9E-01	TBD	0.10
Benzo(a)pyrene	50-32-8	2.9E-03	2.9E-03	TBD	0.0029
Indeno(1,2,3-cd)pyrene	193-39-5	2.9E-02	2.9E-02	TBD	0.029
Dibenzo(a,h)anthracene	53-70-3	2.9E-03	2.9E-03	TBD	0.0029
Benzo(g,h,i)perylene	191-24-2	NA	0.10	TBD	0.10

[1] The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

Matrix: Groundwater
Analytical Group: Pesticides

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
alpha-BHC	319-84-6	1.1E-02	1.1E-02	TBD	0.011
beta-BHC	319-85-7	3.7E-02	3.7E-02	TBD	0.037
delta-BHC	319-86-8	NA	0.050	TBD	0.050
gamma-BHC (Lindane)	58-89-9	6.1E-02	6.1E-02	TBD	0.050
Heptachlor	76-44-8	1.5E-02	1.5E-02	TBD	0.015
Aldrin	309-00-2	4.0E-03	4.0E-03	TBD	0.050
Heptachlor epoxide	1024-57-3	7.4E-03	7.4E-03	TBD	0.0074
Endosulfan I	959-98-8	2.2E+02	2.2E+02	TBD	0.050
Dieldrin	60-57-1	4.2E-03	4.2E-03	TBD	0.0042
4,4 ′-DDE	72-55-9	2.0E-01	2.0E-01	TBD	0.10
Endrin	72-20-8	1.1E+01	1.1E+01	TBD	0.10
Endosulfan II	3 2 3-65-9	2.2E+02	2.2E+02	TBD	0.10
4,4' DDD	72-54-8	2.8E-01	2.8E-01	TBD	0.10
Endosulfan sulfate	1031-07-8	2.2E+02	2.2E+02	TBD	0.10
4,4'-DDT	50-29-3	2.0E-01	2.0E-01	TBD	0.10
Methoxychlor	72-43-5	1.8E+02	1.8E+02	TBD	0.50
Endrin ketone	53494-70-5	1.1E+01	1.1E+01	TBD	0.10
Endrin aldehyde	7421-93-4	1.1E+01	1.1E+01	TBD	0.10
alpha-Chlordane	5103-71-9	1.9E-01	1.9E-01	TBD	0.050
gamma-Chlordane	5103-74-2	1.9E-01	1.9E-01	TBD	0.050
Toxaphene	8001-35-2	6.1E-02	6.1E-02	TBD	0.061

[1] The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

Matrix: Groundwater
Analytical Group: PCBs

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Aroclor-1016	12674-11-2	9.6E-01	9.6E-01	TBD	1.0
Aroclor-1221	11104-28-2	6.8E-03	6.8E-03	TBD	0.0068
Aroclor-1232	11141-16-5	6.8E-03	6.8E-03	TBD	0.0068
Aroclor-1242	53469-21-9	3.4E-02	3.4E-02	TBD	0.034
Aroclor-1248	12672-29-6	3.4E-02	3.4E-02	TBD	0.034
Aroclor-1254	11097-69-1	3.4E-02	3.4E-02	TBD	0.034
Aroclor-1260	11096-82-5	3.4E-02	3.4E-02	TBD	0.034
Aroclor-1262	37324-23-5	NA	1.0	TBD	1.0
Aroclor-1268	11100-14-4	NA	1.0	TBD	1.0

1 The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

Matrix: Groundwater
Analytical Group: PCB Congeners

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,4,4'-TrCB2	PCB-28	7012-37-5	NA	20	TBD	20
2,4,5-TrCB	PCB-29	15862-07-4	NA	20	TBD	20
2,4,6-TrCB	PCB-30	35693-92-6	NA	20	TBD	20
2,4',5-TrCB	PCB-31	16606-02-3	NA	20	TBD	20
2,4',6-TrCB	PCB-32	38444-77-8	NA	20	TBD	20
2',3,4-TrCB	PCB-33	38444-86-9	NA	20	TBD	20
2',3,5-TrCB	PCB-34	37680-68-5	NA	20	TBD	20
3,3',4-TrCB	PCB-35	37680-69-6	NA	20	TBD	20
3,3',5-TrCB	PCB-36	38444-87-0	NA	20	TBD	20
3,4,4'-TrCB	PCB-37	38444-90-5	NA	20	TBD	20
3,4,5-TrCB	PCB-38	53555-66-1	NA	20	TBD	20
3,4',5-TrCB	PCB-39	38444-88-1	NA	20	TBD	20
2,2',3,3'-TeCB	PCB-40	38444-93-8	NA	20	TBD	20
2,2',3,4-TeCB	PCB-41	52663-59-9	NA	20	TBD	20
2,2',3,4'-TeCB	PCB-42	36559-22-5	NA	20	TBD	20
2,2',3,5-TeCB	PCB-43	70362-46-8	NA	20	TBD	20
2,2',3,5'-TeCB2	PCB-44	41464-39-5	NA	20	TBD	20
2,2',3,6-TeCB	PCB-45	70362-45-7	NA	20	TBD	20
2,2',3,6'-TeCB	PCB-46	41464-47-5	NA	20	TBD	20
2,2',4,4'-TeCB	PCB-47	2437-79-8	NA	20	TBD	20
2,2',4,5-TeCB	PCB-48	70362-47-9	NA	20	TBD	20
2,2',4,5'-TeCB	PCB-49	41464-40-8	NA	20	TBD	20
2,2',4,6-TeCB	PCB-50	62796-65-0	NA	20	TBD	20
2,2',4,6'-TeCB	PCB-51	68194-04-7	NA	20	TBD	20
2,2',5,5'-TeCB2	PCB-52	35693-99-3	NA	20	TBD	20
2,2',5,6'-TeCB	PCB-53	41464-41-9	NA	20	TBD	20
2,2',6,6'-TeCB	PCB-54	15968-05-5	NA	20	TBD	20
2,3,3',4'-TeCB	PCB-55	74338-24-2	NA	20	TBD	20
2,3,3',4'-TeCB	PCB-56	41464-43-1	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,3,3',5-TeCB	PCB-57	70424-67-8	NA	20	TBD	20
2,3,3',5'-TeCB	PCB-58	41464-49-7	NA	20	TBD	20
2,3,3',6-TeCB	PCB-59	74472-33-6	NA	20	TBD	20
2,3,4,4'-TeCB	PCB-60	33025-41-1	NA	20	TBD	20
2,3,4,5-TeCB	PCB-61	33284-53-6	NA	20	TBD	20
2,3,4,6-TeCB	PCB-62	54230-22-7	NA	20	TBD	20
2,3,4',5-TeCB	PCB-63	74472-34-7	NA	20	TBD	20
2,3,4',6-TeCB	PCB-64	52663-58-8	NA	20	TBD	20
2,3,5,6-TeCB	PCB-65	33284-54-7	NA	20	TBD	20
2,3',4,4'-TeCB[2]	PCB-66	32598-10-0	NA	20	TBD	20
2,3',4,5-TeCB	PCB-67	73575-53-8	NA	20	TBD	20
2,3',4,5'-TeCB	PCB-68	73575-52-7	NA	20	TBD	20
2,3',4,6-TeCB	PCB-69	60233-24-1	NA	20	TBD	20
2,3',4',5-TeCB	PCB-70	32598-11-1	NA	20	TBD	20
2,3',4',6-TeCB	PCB-71	41464-46-4	NA	20	TBD	20
2,3',5,5'-TeCB	PCB-72	41464-42-0	NA	20	TBD	20
2,3',5',6-TeCB	PCB-73	74338-23-1	NA	20	TBD	20
2,4,4',5-TeCB	PCB-74	32690-93-0	NA	20	TBD	20
2,4,4',6-TeCB	PCB-75	32598-12-2	NA	20	TBD	20
2',3,4,5-TeCB	PCB-76	70362-48-0	NA	20	TBD	20
3,3',4,4'-TeCB[2,3]	PCB-77	32598-13-3	0.0052	20	TBD	0.0052
3,3',4,5-TeCB	PCB-78	70362-49-1	NA	20	TBD	20
3,3',4,5'-TeCB	PCB-79	41464-48-6	NA	20	TBD	20
3,3',5,5'-TeCB	PCB-80	33284-52-5	NA	20	TBD	20
3,4,4',5-TeCB[3]	PCB-81	70362-50-4	0.0017	20	TBD	0.0017
2,2',3,3',4-PeCB	PCB-82	52663-62-4	NA	20	TBD	20
2,2',3,3',5-PeCB	PCB-83	60145-20-2	NA	20	TBD	20
2,2',3,3',6-PeCB	PCB-84	52663-60-2	NA	20	TBD	20
2,2',3,4,4'-PeCB	PCB-85	65510-45-4	NA	20	TBD	20
2,2',3,4,5-PeCB	PCB-86	55312-69-1	NA	20	TBD	20
2,2',3,4,5'-PeCB	PCB-87	38380-02-8	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,2',3,4,6-PeCB	PCB-88	55215-17-3	NA	20	TBD	20
2,2',3,4,6'-PeCB	PCB-89	73575-57-2	NA	20	TBD	20
2,2',3,4',5-PeCB	PCB-90	68194-07-0	NA	20	TBD	20
2,2',3,4',6-PeCB	PCB-91	68194-05-8	NA	20	TBD	20
2,2',3,5,5'-PeCB	PCB-92	52663-61-3	NA	20	TBD	20
2,2',3,5,6-PeCB	PCB-93	73575-56-1	NA	20	TBD	20
2,2',3,5,6'-PeCB	PCB-94	73575-55-0	NA	20	TBD	20
2,2',3,5',6-PeCB	PCB-95	38379-99-6	NA	20	TBD	20
2,2',3,4,6'-PeCB	PCB-89	73575-57-2	NA	20	TBD	20
2,2',3,4',5-PeCB	PCB-90	68194-07-0	NA	20	TBD	20
2,2',3,4',6-PeCB	PCB-91	68194-05-8	NA	20	TBD	20
2,2',3,5,5'-PeCB	PCB-92	52663-61-3	NA	20	TBD	20
2,2',3,5,6-PeCB	PCB-93	73575-56-1	NA	20	TBD	20
2,2',3,5,6'-PeCB	PCB-94	73575-55-0	NA	20	TBD	20
2,2',3,5',6-PeCB	PCB-95	38379-99-6	NA	20	TBD	20
2,2',3,6,6'-PeCB	PCB-96	73575-54-9	NA	20	TBD	20
2,2',3',4,5-PeCB	PCB-97	41464-51-1	NA	20	TBD	20
2,2',3',4,6-PeCB	PCB-98	60233-25-2	NA	20	TBD	20
2,2',4,4',5-PeCB	PCB-99	38380-01-7	NA	20	TBD	20
2,2',4,4',6-PeCB	PCB-100	39485-83-1	NA	20	TBD	20
2,2',4,5,5'-PeCB2	PCB-101	37680-73-2	NA	20	TBD	20
2,2',4,5,6'-PeCB	PCB-102	68194-06-9	NA	20	TBD	20
2,2',4,5',6-PeCB	PCB-103	60145-21-3	NA	20	TBD	20
2,2',4,6,6'-PeCB	PCB-104	56558-16-8	NA	20	TBD	20
2,3,3',4,4'-PeCB2,3	PCB-105	32598-14-4	0.0017	20	TBD	0.0017
2,3,3',4,5-PeCB	PCB-106	70424-69-0	NA	20	TBD	20
2,3,3',4',5-PeCB	PCB-107	70424-68-9	NA	20	TBD	20
2,3,3',4,5'-PeCB	PCB-108	70362-41-3	NA	20	TBD	20
2,3,3',4,6-PeCB	PCB-109	74472-35-8	NA	20	TBD	20
2,3,3',4',6-PeCB	PCB-110	38380-03-9	NA	20	TBD	20
2,3,3',5,5'-PeCB	PCB-111	39635-32-0	NA	20	TBD	20
2,3,3',5,6-PeCB	PCB-112	74472-36-9	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,3,3',5',6-PeCB	PCB-113	68194-10-5	NA	20	TBD	20
2,3,4,4',5-PeCB3	PCB-114	74472-37-0	0.0017	20	TBD	0.0017
2,3,4,4',6-PeCB	PCB-115	74472-38-1	NA	20	TBD	20
2,3,4,5,6-PeCB	PCB-116	18259-05-7	NA	20	TBD	20
2,3,4',5,6-PeCB	PCB-117	68194-11-6	NA	20	TBD	20
2,3',4,4',5-PeCB2,3	PCB-118	31508-00-6	0.0017	20	TBD	0.0017
2,3',4,4',6-PeCB	PCB-119	56558-17-9	NA	20	TBD	20
2,3',4,5,5'-PeCB	PCB-120	68194-12-7	NA	20	TBD	20
2,3',4,5,'6-PeCB	PCB-121	56558-18-0	NA	20	TBD	20
2',3,3',4,5-PeCB	PCB-122	76842-07-4	NA	20	TBD	20
2',3,4,4',5-PeCB3	PCB-123	65510-44-3	0.0017	20	TBD	0.0017
2',3,4,5,5'-PeCB	PCB-124	70424-70-3	NA	20	TBD	20
2',3,4,5,6'-PeCB	PCB-125	74472-39-2	NA	20	TBD	20
3,3',4,4',5-PeCB2,3	PCB-126	57465-28-8	0.17	20	TBD	0.17
3,3',4,5,5'-PeCB	PCB-127	39635-33-1	NA	20	TBD	20
2,2',3,3',4,4'-HxCB2	PCB-128	38380-07-3	NA	20	TBD	20
2,2',3,3',4,5-HxCB	PCB-129	55215-18-4	NA	20	TBD	20
2,2',3,3',4,5'-HxCB	PCB-130	52663-66-8	NA	20	TBD	20
2,2',3,3',4,6-HxCB	PCB-131	61798-70-7	NA	20	TBD	20
2,2',3,3',4,6'-HxCB	PCB-132	38380-05-1	NA	20	TBD	20
2,2',3,3',5,5'-HxCB	PCB-133	35694-04-3	NA	20	TBD	20
2,2',3,3',5,6-HxCB	PCB-134	52704-70-8	NA	20	TBD	20
2,2',3,3',5,6'-HxCB	PCB-135	52744-13-5	NA	20	TBD	20
2,2',3,3',6,6'-HxCB	PCB-136	38411-22-2	NA	20	TBD	20
2,2',3,4,4',5-HxCB	PCB-137	35694-06-5	NA	20	TBD	20
2,3,3',5,5'-PeCB	PCB-111	39635-32-0	NA	20	TBD	20
2,3,3',5,6-PeCB	PCB-112	74472-36-9	NA	20	TBD	20
2,2',3,4,4',5'-HxCB2	PCB-138	35065-28-2	NA	20	TBD	20
2,2',3,4,4',6-HxCB	PCB-139	56030-56-9	NA	20	TBD	20
2,2',3,4,4',6'-HxCB	PCB-140	59291-64-4	NA	20	TBD	20
2,2',3,4,5,5'-HxCB	PCB-141	52712-04-6	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,2',3,4,5,6-HxCB	PCB-142	41411-61-4	NA	20	TBD	20
2,2',3,4,5,6'-HxCB	PCB-143	68194-15-0	NA	20	TBD	20
2,2',3,4,5',6-HxCB	PCB-144	68194-14-9	NA	20	TBD	20
2,2',3,4,6,6'-HxCB	PCB-145	74472-40-5	NA	20	TBD	20
2,2',3,4',5,5'-HxCB	PCB-146	51908-16-8	NA	20	TBD	20
2,2',3,4',5,6-HxCB	PCB-147	68194-13-8	NA	20	TBD	20
2,2',3,4',5,6'-HxCB	PCB-148	74472-41-6	NA	20	TBD	20
2,2',3,4',5',6-HxCB	PCB-149	38380-04-0	NA	20	TBD	20
2,2',3,4',6,6'-HxCB	PCB-150	68194-08-1	NA	20	TBD	20
2,2',3,5,5',6-HxCB	PCB-151	52663-63-5	NA	20	TBD	20
2,2',3,5,6,6'-HxCB	PCB-152	68194-09-2	NA	20	TBD	20
2,2',4,4',5,5'-HxCB2	PCB-153	35065-27-1	NA	20	TBD	20
2,2',4,4',5',6-HxCB	PCB-154	60145-22-4	NA	20	TBD	20
2,2',4,4',6,6'-HxCB	PCB-155	33979-03-2	NA	20	TBD	20
2,3,3',4,4',5-HxCB3	PCB-156	38380-08-4	0.0017	20	TBD	0.0017
2,3,3',4,4',5'-HxCB3	PCB-157	69782-90-7	0.0017	20	TBD	0.0017
2,3,3',4,4',6-HxCB	PCB-158	74472-42-7	NA	20	TBD	20
2,3,3',4,5,5'-HxCB	PCB-159	39635-35-3	NA	20	TBD	20
2,3,3',4,5,6-HxCB	PCB-160	41411-62-5	NA	20	TBD	20
2,3,3',4,5',6-HxCB	PCB-161	74472-43-8	NA	20	TBD	20
2,3,3',4',5,5'-HxCB	PCB-162	39635-34-2	NA	20	TBD	20
2,3,3',4',5,6-HxCB	PCB-163	74472-44-9	NA	20	TBD	20
2,3,3',4',5',6-HxCB	PCB-164	74472-45-0	NA	20	TBD	20
2,3,3',5,5',6-HxCB	PCB-165	74472-46-1	NA	20	TBD	20
2,3,4,4',5,6-HxCB	PCB-166	41411-63-6	NA	20	TBD	20
2,3',4,4',5,5'-HxCB3	PCB-167	52663-72-6	0.0017	20	TBD	0.0017
2,3',4,4',5',6-HxCB	PCB-168	59291-65-5	NA	20	TBD	20
3,3',4,4',5,5'-HxCB2,3	PCB-169	32774-16-6	0.000017	20	TBD	0.000017
2,2',3,3',4,4',5-HpCB2	PCB-170	35065-30-6	NA	20	TBD	20
2,2'3,3',4,4',6-HpCB	PCB-171	52663-71-5	NA	20	TBD	20
2,2',3,3',4,5,5'-HpCB	PCB-172	52663-74-8	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,2',3,3',4,5,6-HpCB	PCB-173	68194-16-1	NA	20	TBD	20
2,2',3,3',4,5,6'-HpCB	PCB-174	38411-25-5	NA	20	TBD	20
2,2',3,3',4,5',6-HpCB	PCB-175	40186-70-7	NA	20	TBD	20
2,2',3,3',4,6,6'-HpCB	PCB-176	52663-65-7	NA	20	TBD	20
2,2',3,3',4',5,6-HpCB	PCB-177	52663-70-4	NA	20	TBD	20
2,2',3,3',5,5',6-HpCB	PCB-178	52663-67-9	NA	20	TBD	20
2,2',3,3',5,6,6'-HpCB	PCB-179	52663-64-6	NA	20	TBD	20
2,2',3,4,4',5,5'-HpCB2	PCB-180	35065-29-3	NA	20	TBD	20
2,2',3,4,4',5,6-HpCB	PCB-181	74472-47-2	NA	20	TBD	20
2,2',3,4,4',5,6'-HpCB	PCB-182	60145-23-5	NA	20	TBD	20
2,2',3,4,4',5',6-HpCB	PCB-183	52663-69-1	NA	20	TBD	20
2,2',3,4,4',6,6'-HpCB	PCB-184	74472-48-3	NA	20	TBD	20
2,2',3,4,5,5',6-HpCB	PCB-185	52712-05-7	NA	20	TBD	20
2,2',3,4,5,6,6'-HpCB	PCB-186	74472-49-4	NA	20	TBD	20
2,2',3,4',5,5',6-HpCB2	PCB-187	52663-68-0	NA	20	TBD	20
2,2',3,4',5,6,6'-HpCB	PCB-188	74487-85-7	NA	20	TBD	20
2,3,3',4,4',5,5'-HpCB3	PCB-189	39635-31-9	0.0017	20	TBD	0.0017
2,3,3',4,4',5,6-HpCB	PCB-190	41411-64-7	NA	20	TBD	20
2,3,3',4,4',5',6-HpCB	PCB-191	74472-50-7	NA	20	TBD	20
2,3,3',4,5,5',6-HpCB	PCB-192	74472-51-8	NA	20	TBD	20
2,3,3',4',5,5',6-HpCB	PCB-193	69782-91-8	NA	20	TBD	20
2,2',3,3',4,4',5,5'-OcCB	PCB-194	35694-08-7	NA	20	TBD	20
2,2',3,3',4,4',5,6-OcCB2	PCB-195	52663-78-2	NA	20	TBD	20
2,2',3,3',4,4',5,6'-OcCB	PCB-196	42740-50-1	NA	20	TBD	20
2,2',3,3',4,4',6,6'-OcCB	PCB-197	33091-17-7	NA	20	TBD	20
2,2',3,3',4,5,5',6-OcCB	PCB-198	68194-17-2	NA	20	TBD	20
2,2',3,3',4,5,5',6'-OcCB	PCB-199	52663-75-9	NA	20	TBD	20
2,2',3,3',4,5,6,6'-OcCB	PCB-200	52663-73-7	NA	20	TBD	20
2,2',3,3',4,5',6,6'-OcCB	PCB-201	40186-71-8	NA	20	TBD	20
2,2',3,3',5,5',6,6'-OcCB	PCB-202	2136-99-4	NA	20	TBD	20
2,2',3,4,4',5,5',6-OcCB	PCB-203	52663-76-0	NA	20	TBD	20

Analyte	Congener Name	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
					MDL	CRQL
2,2',3,4,4',5,6,6'-OcCB	PCB-204	74472-52-9	NA	20	TBD	20
2,3,3',4,4',5,5',6-OcCB	PCB-205	74472-53-0	NA	20	TBD	20
2,2',3,3',4,4',5,5',6-$NoCB_2$	PCB-206	40186-72-9	NA	20	TBD	20
2,2',3,3',4,4',5,6,6'-NoCB	PCB-207	52663-79-3	NA	20	TBD	20
2,2',3,3',4,5,5',6,6'-NoCB	PCB-208	52663-77-1	NA	20	TBD	20
$DeCB_2$	PCB-209	2051-24-3	NA	20	TBD	20

The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

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Matrix: Groundwater

Analytical Group: Dioxins/Furans

Analyte	CAS Number	Project Screening Level[1] (pg/L)	Project Quantitation Limit Goal (pg/L)	Achievable Laboratory Limits	
				MDL	CRQL
2378-TCDD	1746-01-6	5.2E-01	30	TBD	0.52
12378-PeCDD	40321-76-4	NA	50	TBD	50
123678-HxCDD	57653-85-7	NA	50	TBD	50
123478-HxCDD	39227-28-6	NA	50	TBD	50
123789-HxCDD	19408-74-3	NA	50	TBD	50
1234678-HpCDD	35822-46-9	NA	50	TBD	50
OCDD	3268-87-9	NA	100	TBD	100
2378-TCDF	51207-31-9	NA	10	TBD	10
12378-PeCDF	57117-41-6	NA	50	TBD	50
23478-PeCDF	57117-31-4	NA	50	TBD	50
123678-HxCDF	57117-44-9	NA	50	TBD	50
123789-HxCDF	72918-21-9	NA	50	TBD	50
123478-HxCDF	70648-26-9	NA	50	TBD	50
234678-HxCDF	60851-34-5	NA	50	TBD	50
1234678-HpCDF	67562-39-4	NA	50	TBD	50
1234789-HpCDF	55673-89-7	NA	50	TBD	50
OCDF	39001-02-0	NA	10	TBD	100

[1] The Project Screening Levels are the Region III SLs for Tapwater (May 2010).

Matrix: Groundwater

Analytical Group: TAL Metals

Analyte	CAS Number	Project Screening Level[1] (µg/L)	Project Quantitation Limit Goal (µg/L)	Achievable Laboratory Limits	
				MDL	CRQL
Aluminum	7429-90-5	3.7E+04	3.7E+04	TBD	20
Antimony	7440-36-0	1.5E+01	1.5E+01	TBD	2
Arsenic	7440-38-2	4.5E-02	4.5E-02	TBD	0.045
Barium	7440-39-3	7.3E+03	7.3E+03	TBD	10
Beryllium	7440-41-7	7.3E+01	7.3E+01	TBD	1
Cadmium	7440-43-9	1.8E+01	1.8E+01	TBD	1
Calcium	7440-70-2	NA	500	TBD	500
Chromium	7440-47-3	4.3E-02	4.3E-02	TBD	2
Cobalt	7440-48-4	1.1E+01	1.1E+01	TBD	1
Copper	7440-50-8	1.5E+03	1.5E+03	TBD	2
Iron	7439-89-6	2.6E+04	2.6E+04	TBD	200
Lead	7439-92-1	1.5E+01	1.5E+01	TBD	1
Magnesium	7439-95-4	NA	500	TBD	500
Manganese	7439-96-5	8.8E+02	8.8E+02	TBD	1
Mercury	7439-97-6	3.7E+00	3.7E+00	TBD	0.2
Nickel	7440-02-0	7.3E+02	7.3E+02	TBD	1
Potassium	7440-09-7	NA	500	TBD	500
Selenium	7782-49-2	1.8E+02	1.8E+02	TBD	5
Silver	7440-22-4	1.8E+02	1.8E+02	TBD	1
Sodium	7440-23-5	NA	500	TBD	500
Thallium	7440-28-0	2.0E+00	2.0E+00	TBD	1
Vanadium	7440-62-2	2.6E+00	2.6E+00	TBD	2.6
Zinc	7440-66-6	1.1E+04	1.1E+04	TBD	2
Cyanide	57-12-5	7.3E+02	7.3E+02	TBD	10

[1] The Project Screening Levels are the Region III SLs for Tapwater (May 2010) except for lead and thallium which the PSLs are the Federal Maximum Contaminant Levels (MCLs).

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SAP Worksheet #16 – Project Schedule / Timeline Table

Project Schedule / Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Additional Bedrock Boring Installation - 6 well pairs (total of 12 wells)	TtNUS	January 2011	February 2011	Provide analytical results to USEPA RPM	March 2011
Discrete Zone Packer Testing	TtNUS	January 2011	February 2011	Provide analytical results to USEPA RPM	March 2011
Borehole Geophysics	TtNUS	January 2011	February 2011	Provide summary of geophysics report to USEPA RPM	March 2011
New Well installation and well development	TtNUS	January 2011	February 2011	Provide summary of boring and well installation to USEPA RPM	March 2011
Monitoring Well Sampling	TtNUS	February 2011	March 2011	Provide analytical results to USEPA RPM	April 2011
Groundwater Flow Modeling	TtNUS	January 2011	February 2011	Provide summary of groundwater flow model to USEPA RPM	April 2011

SAP Worksheet #17 – Sampling Design and Rationale

Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

- Installation of 12 additional monitoring wells (six well pairs) will further delineate the lateral and vertical extent of the site groundwater contamination. Each well pair will consist of a bedrock screened well (well identification with suffix "D") and a shallow aquifer screened well (well identification with suffix "S"). Packer testing of discrete zones within two deeper drilling boreholes will be performed to aid in determination of the final screened intervals for each of the well. Groundwater samples will be collected from each of the packer testing zones and analyzed for TCL Volatile Organic Compounds, . Groundwater from the monitoring events will be analyzed for TCL Organics, TAL Inorganics (total and dissolved), dioxins and furans, and 1,4-dioxane analyses.

- Monitoring event groundwater samples will be collected from each of the 12 new monitoring wells (MW-13S/D, MW-14S/D, MW-15S/D, MW-16S/D, MW-17S/D, and MW-18S/D) and 15 existing site monitoring wells (MW-01S/D, MW-02, MW-03, MW-04, MW-05S/D, MW-06, MW-07S/D, MW-08, MW-09, MW-10, MW-11, and MW-12). The purpose of the sampling effort is to obtain water quality data is to better define the vertical and lateral extent of contamination at the site in support of future remediation efforts.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

See Worksheet #18.

Worksheet #17 (Continued) - Proposed Sampling Analysis

Sample Location	Sample Media	# Of Samples(1)	Type of Analysis	Analytical Goals (b)
Additional Boring Installation (Discrete Zone packer Testing)				
Additional MW Deep Borings (MW13 and MW14)	Formation Groundwater (prior to well installation)	Up to 3 per bedrock boring (1 per discrete packer test zone) x 2 boreholes = 6	- Trace VOCs, by CLP SOM01.2	All samples (48-hour TAT for Preliminary Data)
Groundwater Sampling After Well Installation				
All Site Monitoring Wells (existing and newly installed)	Monitoring Well Groundwater	27	- Trace VOCs, by CLP SOM01.2 - SVOC, pesticide, PCB, by CLP SOM01.2 - PAHs and 1,4-Dioxane by CLP SOM01.2 SIM - Dioxins/Furans - TAL Metals (Total and Dissolved), Cyanide by CLP ISM01.2 - 1,4-Dioxane -Field Measurements: pH, temperature, DO, conductivity, ORP, turbidity	All samples

(1) does not include QC samples
(2) *Proposed sampling and boring/well locations are depicted on Figure 1 in* ***Appendix B.***

SAP Worksheet #18 – Sampling Locations and Methods / SOP Requirements Table

Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concent. Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location
Packer Test Screening Samples							
LDCA-MW13-PT-(*depth*)-MMYY LDCA-MW14-PT-(*depth*)-MMYY (deep well boreholes)	Formation Water	TBD by packer intervals	TCL VOCs,	Trace	6 (Up to 3 samples from first 2 deep boreholes) (plus 1 field duplicate) (actual number based upon field conditions)	SA-1.1 (grab samples)	Determine water quality for discrete zones within formation
Groundwater Sampling Newly Constructed Wells							
LDCA-MW01S-MMYY LDCA-MW01D-MMYY LDCA-MW02-MMYY LDCA-MW03-MMYY LDCA-MW04-MMYY LDCA-MW05S-MMYY LDCA-MW05D-MMYY LDCA-MW6-MMYY LDCA-MW07S-MMYY LDCA-MW07D-MMYY LDCA-MW08-MMYY LDCA-MW09-MMYY LDCA-MW10-MMYY LDCA-MW11-MMYY LDCA-MW12-MMYY LDCA-MW13S-MMYY LDCA-MW13D-MMYY LDCA-MW14S-MMYY LDCA-MW14D-MMYY LDCA-MW15S-MMYY LDCA-MW15D-MMYY LDCA-MW16S-MMYY LDCA-MW16D-MMYY LDCA-MW17S-MMYY LDCA-MW17D-MMYY LDCA-MW18S-MMYY LDCA-MW18D-MMYY	Groundwater	(Screened intervals)	TCL Organics, TAL Inorganics (total and dissolved), Cyanide, and 1,4-Dioxane, dioxins and furans,	Trace	27 (plus 3 field duplicates)	SA-1.1 (low flow)	Fill data gaps for additional groundwater characterization

[1]SOPs are from the Field SOP References table (Worksheet 21).

SAP Worksheet #19 – Analytical SOP Requirements

Matrix	Analytical Group	Concentration Level	Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum (preparation/ analysis)
Groundwater	TCL VOCs	Trace	SOM01.2	120 milliliters (mL)	3 – 40mL glass vials with Teflon septum	Cool to 4±2 degrees Celsius (°C) with Hydrochloric Acid (HCl) to pH<2; no headspace	14 days to analysis
Groundwater	TCL SVOCs, PAHs, and 1,4-Dioxane	Low	SOM01.2	2 Liter (L)	2 – 1L amber glass bottles	Cool to 4±2°C	14 days to analysis
Groundwater	Pesticides, PCBs	Low	SOM01.2	2 L	2 – 1L amber glass bottles	Cool to 4±2°C	14 days to analysis
Groundwater	PCB congeners	Low	CBC01.2	2 L	2 – 1L amber glass bottles	Cool to 4±2°C	35 days to analysis
Groundwater	Dioxins and Furans	Low	DLM02.0	2 L	2 – 1L amber glass bottles	Cool to 4±2°C	30 days to analysis
Groundwater	Hexavalent Chromium	Low	SW-846 7199	125 ml	1 – 125 ml plastic bottle	Cool to 4±2°C	24 hours
Groundwater	TAL Metals (Total and Dissolved)	Low	ISM01.2 ICP-MS	2 liters (L)	2 – 1L plastic bottles	Cool to 4±2°C with Nitric Acid (HNO_3) to pH<2	6 months to analysis (28 days for mercury)
Groundwater	Cyanide	Low	ISM01.2	1 L	1 – 1l plastic bottle	Cool to 4±2°C with Sodium Hydroxide (NaOH) to pH>12	14 days to analysis

[1]SOPs are from the Analytical SOP References table (Worksheet_#23).

SAP Worksheet #20 – Field Quality Control Sample Summary Table

Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/ Laboratory Duplicate	No. of Field Blanks	No. of Equip. Blanks	No. of trip blank Samples	Total No. of Samples to Lab
Packer Test Screening Samples										
Groundwater	VOCs	Trace	SOM01.2	6	1	NA	NA	NA	2 (one per borehole)	9
Groundwater Sampling										
Groundwater	VOCs	Trace	SOM01.2	27	3	1	1	1	5 (one per cooler containing VOC samples)	38
	SVOCs	Low	SOM01.2	27	3	1	1	1	NA	33
	PAHs and 1,4-Dioxane	SIM	SOM01.2	27	3	1	1	1	NA	33
	Pesticides, PCBs	Low	SOM01.2	27	3	1	1	1	NA	33
	PCB congeners	Low	CBC01.2	27	3	1	1	1	NA	33
	TAL Metals (Total and dissolved)	Trace	ISM01.2 ICP-MS	27	3	1	1	1	NA	33
	Hexavalent Chromium	Low	SW-846 7199	27	3	1	1	1	NA	33
	Dioxins and Furans	Low	DLM02.0	27	3	1	1	1	NA	33

[1]SOP from the Analytical SOP References table (Worksheet_#23).

SAP Worksheet #21 - Project Sampling SOP References Table

Methods for sample collection are described in SOPs listed in the table below have been developed to ensure sample quality (integrity and representativeness). USEPA CLP specific sampling protocols (e.g., sample handling, preservation, shipping, holding times, etc.) will be conducted in manner consistent with the USEPA Contract Laboratory Program Guidance for Field Samplers" (USEPA-540-R-07-06, FINAL July 2007).

Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
GH-1.2	Evaluation of Existing Monitoring Wells and Water Level Measurement (Revision 2, September 2003)	TtNUS	Water Level Meter	N	
GH-1.3	Soil and Rock Drilling Methods (Revision 1, June 1999)	TtNUS	Drill rig	N	
GH-1.5	Borehole and Sample Logging (Revision 1,/ June 1999)	TtNUS	Drill rig	N	
GH-2.2	Packer Tests (Revision 1, June 1999)	TtNUS	Drill rig	N	
GH-2.8	Groundwater Monitoring Well Installation (Revision 3, September 2003)	TtNUS	Drill rig	N	
USEPA Region III QAD023	USEPA Low Flow Purging and Sampling	USEPA	Submersible pump, water quality indicator, and water level probe	N	Monitoring well sampling
SA-1.1	Groundwater Sample Acquisition And Onsite Water Quality Testing (Revision 7, May 2008)	TtNUS	Submersible pump, water quality indicator, and water level probe	Y	Samples collected during borehole packer testing, through packers
SA-2.2	Air Monitoring and Sampling and Calibration (Revision 1, September 2003)	TtNUS	Photo ionization detector (PID)	N	
SA-6.3	Field Documentation (Revision 3, March 2009)	TtNUS	Field Logbook, Field Sample Forms, Boring Logs	N	

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SA-7.1	Decontamination of Field Equipment (Revision 6, January 2009)	TtNUS	Decontamination Equipment (scrub brushes, phosphate free detergent, de-ionized water)	N	
Per USEPA CLP Guidance for Field Samplers	Sample Preservation Aqueous Samples	USEPA	Various	N	Forms II Lite will be used for tracking samples, creating TR/COCs, sample labels, and tags
	Sample Containers, Volumes and Preservatives				
	Sample Tags				
	Traffic Report and Chain of Custody Forms				
	Sample Shipping				
	QC Sampling				
	Reporting Sample Shipment				

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Grundfos II Submersible pump	NA	Decontamination	Daily Use	Daily Use	After each well	NA	Replace	FOL	SA-1.1
Peristaltic Pump	NA	NA	Daily Use	Daily Use	Daily	NA	Replace	FOL	SA-1.1
YSI-556 Water Quality Indicator	Measure pH 4.0 and 10.0, DO and ORP	Decontamination	Daily calibration	Daily Use	After each well	Within range of +/- 0.1 of buffer solution	Replace	FOL	SA-1.1
Water level indicator	NA	Decontamination	Daily use	Daily use	Daily	NA	Replace	FOL	GH-1.2
PID	Measure 100 parts per million (ppm) of Isobutylene	Calibration	Daily calibration	Daily use	Daily	Within range of +/- 10 ppm of calibration gas	Replace	FOL	SA-2.2

[1]SOP from the Project Sampling SOP References table (Worksheet 21).

INSPECTIONS
Periodic regular inspection of equipment and instruments is needed to assure the satisfactory performance of the systems. Equipment to be used during the sampling event is listed in the appropriate SOPs. Before any piece of sampling or measurement equipment is taken into the field it will be inspect to ensure the following: it is appropriate for the task to be performed, all necessary parts of the equipment are intact, and it is in working order. In addition, equipment will be visually inspected prior to its use. Broken equipment will be tagged "DO NOT USE" and returned to the TtNUS office to receive the necessary repairs, or will be disposed. Backup field equipment will be available during all field activities in the event of an equipment breakdown.

MAINTENANCE
The objective of preventive maintenance is to ensure the availability and satisfactory performance of the measurement systems. All field measurement instruments will receive preventative maintenance in accordance with the manufacturer's specifications.

INSTRUMENT CALIBRATION AND FREQUENCY
Periodic regular calibration of specific instruments is needed to assure the satisfactory performance of the systems. Calibration procedures and preventative maintenance to be used on field equipment during the LDCA RI are presented in the following TtNUS SOPs. All calibration and maintenance activities (and anomalies) are noted in the field documentation (SOP SA-6.3). The SOPs are included in **Attachment B** of the SAP.

REQUIREMENTS FOR INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies and consumables are those items necessary to support the sampling and analytical operation, including but not limited to: bottleware, calibration gases, hoses, decontamination supplies, preservatives, various types of water (potable, de-ionized, organic-free, etc.). Upon receipt of supplies, the TtNUS site manager will ensure that types and quantities of supplies received is consistent with what was ordered and what is indicated on the packing list and invoice for the material. The supplier will be contacted immediately if there is any discrepancy identified.

REQUIREMENTS FOR ACCEPTANCE OF OUTSIDE DATA

Comparison of data collected during this field effort to historic data will be for qualitative assessment only. Any data collected previously and validated in accordance with USEPA protocol will be incorporated into quantitative assessment where appropriate, as it was collected according to and is assumed to conform to the same standards as the RI work plan.

SAP Worksheet #23 – Analytical SOP References Table

Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CLP SOW SOM01.2 - Trace VOCs	Analytical Method for the Analysis of Trace Concentrations of Volatile Organic Compounds	Definitive	VOCs in Groundwater	Gas Chromatograph/Mass Spectrometer (GC/MS)	TBD	No
CLP SOW SOM01.2	Analytical Method for the Analysis of Semivolatile Organic Compounds	Definitive	SVOCs (scan), PAHs and 1,4-Dioxane (SIM)	GC/MS	TBD	No
	Analytical Method for the Analysis of Pesticides	Definitive	Pesticides	Gas Chromatograph/Electron Capture Detector GC/ECD	TBD	No
	Analytical Method for the Analysis of Aroclors	Definitive	PCBs	GC/ECD	TBD	No
CLP SOW CBC01.2	Multi-Media, Multi-Concentration Chlorinated Biphenyl Congeners Analysis	Definitive	PCB Congeners	High Resolution Gas Chromatograph/ High Resolution Mass Spectrometer (HRGC/HRMS)	TBD	No
CLP SOW DLM02.0	Multi-Media, Multi-Concentration Dioxins and Furans Analysis	Definitive	Dioxin/Furans	HRGC/HRMS	TBD	No
CLP SOW ISM01.2 ICP-MS	Analytical Method for the Analysis of Multi-Concentrations Inorganic Analysis	Definitive	TAL Metals (including nutrients) in Groundwater	Inductively Coupled Plasma/Mass Spectrometer (ICP-MS)	TBD	No
SW-846 7199	Determination of Hexavalent Chromium in Drinking Water, Groundwater, and Industrial Wastewater Effluents by Ion Chromatography	Definitive	Hexavalent Chromium	Ion Chromatograph (IC)	TBD	No

Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
RSKSOP-175	Sample Preparation and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique	Definitive	Methane	GC	TBD	No
EPA 300.0	Determination of Inorganic Anions by Ion Chromatography	Definitive	Anions (nitrate and sulfate)	IC	TBD	No
SM21 3500-Fe B by Chemetrics Test Kit K-6210	The Phenanthroline Colorimetric Procedure (total & ferrous iron)	Definitive	Ferrous $^{(+2)}$ / Ferric Iron $^{(+3)}$	NA	TBD	No
SM 2320B	Titration Method for Alkalinity	Definitive	Alkalinity	NA	TBD	No
SM 5310	Total Organic Carbon	Definitive	TOC	NA	TBD	No

SAP Worksheet #24 – Analytical Instrument Calibration Table

Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
GC/MS	Instrument Performance Check (BFB/DFTPP Tuning)	Beginning of each 12 hour period during which samples are to be analyzed.	Meets ion abundance criteria in method Table 1	Re-tune the GC/MS system. May need to clean ion source and/or quadrupole rods. BFB/DFTPP criteria must be met before any other samples are analyzed.	Analyst/Supervisor	SOM01.2 VOC, SVOC, PAH, and 1,4-DIoxane
	Initial Calibration (minimum 5 points)	Instrument receipt, instrument change (new trap, column, etc.), when CCV does not meet criteria	1. Relative response factor (RRF) must be ≥ criteria in Table 2 of method. 2. Relative standard deviation (RSD) must be ≤ criteria in Table 2 of method. 3. Up to 2 target compounds may fail RRF but must meet RRF of 0.01 or up to 2 targets may fail RSD but meet max. RSD requirement of 40%.	1. Inspect the system. May be necessary to clean ion source, change column, or service purge-and-trap device in addition to other Corrective Action. 2. Recalibrate.	Analyst/Supervisor	
	Continuing Calibration Verification (CCV)	Prior to analysis of samples and after BFB/DFTPP tuning. At the end of each 12-hour shift.	1. Must be at or near the mid-point concentration. 2. RRF ≥ criteria in method Table 3. %Difference (%D) within range of Table 2 criteria. 4. Up to 2 RRFs may fail but must meet RRF of 0.01 or up to 2 targets may fail RSD but meet max. RSD requirement of 40%.	Re-calibrate. If closing CCV fails, samples must be reanalyzed. May be necessary to clean ion source, change column, or service purge-and-trap device in addition to other Corrective Action.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
GC/ECD	Initial Calibration (minimum 5 points)	Contract award, major instrument maintenance or modification, or calibration verification have not been met.	Resolution between adjacent peaks >80% in Resolution Check Mixture Single components resolution ≥90% Within RT windows Percent difference ≤25% Percent breakdown of DDT and Endrin ≤20% combined breakdown ≤30% %RSD for CF ≤20% except for a-BHC and d-BHC which is ≤25%	Check system for problems and make maintenance corrective actions as necessary. Recalibrate.	Analyst/ Supervisor	SOM01.2 Pesticides and PCBs
	Continuing Calibration Verification (CCV)	Bracket 12-hour analysis window with appropriate standard mixtures.	Single components resolution ≥90% Within RT windows Percent difference ≤25% Percent breakdown of DDT and Endrin ≤20% combined breakdown ≤30% %D for CF ≤20%	Check system for problems and make maintenance corrective actions as necessary. Recalibrate. May need to do a new initial calibration.	Analyst/ Supervisor	
HRGC/HRMS	System Tune	Beginning of each 12 hour analysis period.	The HRMS static resolving power must be greater than or equal to10,000, and the deviation between the exact m/z and the theoretical m/z for each exact m/z monitored must be less than 5ppm.	Retune until technical acceptance criteria are met. Do not analyze samples until System Tune meets criteria.	Analyst/ Supervisor	DLM02.0 Dioxins/Furans

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Window Defining Mixture (WDM)	After the tune and before any initial calibration each instrument and HRGC column used for analysis; C Once at the beginning of each 12-hour period during which standards or samples are analyzed; and C Whenever adjustments or instrument maintenance activities are performed that may affect RTs.	The analysis of WDM is acceptable if the criteria given in Table 5 of the method are met.	Technical acceptance criteria must be met before any standards, samples, QC samples, and required blanks are analyzed. Any analysis conducted when the technical acceptance criteria have not been met will require re-analysis at no additional cost to USEPA. 9.2.3.4.2 If the technical acceptance criteria at the end of the 12-hourshift or analytical sequence are not met, all sample analyzed in that shift or analytical sequence having positive hits will be reanalyzed at no additional cost to USEPA. 9.2.3.4.3 If the technical acceptance criteria are not met, the instrument must be adjusted and the test repeated or the HRGC column must be replaced.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Isomer Specificity Check	After, or simultaneously with the WDM and before any initial calibration on each instrument and HRGC column used for analysis; C Once at the beginning of each 12-hour period during which standards or samples are analyzed, and C Whenever adjustments or instrument maintenance activities are performed that may affect retention times.	The isomer specificity check is acceptable if the height of the valley between the least resolved adjacent isomer and the 2,3,7,8-substited isomers ≤25%	If the technical acceptance criteria are not met, the instrument must be adjusted and the test repeated or the HRGC column must be replaced.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Initial Calibration Each HRGC/HRMS system must be calibrated at a minimum of five concentrations to determine instrument sensitivity and the linearity of the HRGC/HRMS response for the target analytes.	Prior to the analysis of samples and required blanks, and after the HRGC/HRMS system performance check criteria have been met	1. All initial calibration standards must be analyzed at the concentration level and frequency described. 2. The isomer specificity shall be resolved with a valley of # 25% in all calibration standards. 3. The isotopic ratios must be within the limits specified in Table 9. 4. The S/N ratios for the HRGC/HRMS signal in every SICP must be > 10. 5. The RTs of the isomers must fall within the appropriate RT windows established by analysis of the WDM. 6. The % RSD for the RR must be +/- 20% and the RSD for the RRF must be +/- 35% over the five pt calibration range. 7. Calibration verification consists of verification of the Mid-Point Calibration Standard (CS3) RR and RRF.	Recalibrate.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Calibration Verification	Beginning of each 12 hour analysis period. Prior to the analysis of samples and required blanks, and after then HRGC/HRMS system performance check criteria have been met.	1. All initial calibration standards must be analyzed at the concentration level and frequency described. 2. The isomer specificity shall be resolved with a valley of # 25% in all calibration standards. 3. The isotopic ratios must be within the limits specified in Table 9. 4. The S/N ratios for the HRGC/HRMS signal in every SICP must be > 10. 5. The RTs of the isomers must fall within the appropriate RT windows established by analysis of the WDM. 6. The % difference (%D) for the RR must be +/- 25% and the %D of the RRF must be +/- 35% from the initial calibration. 7. Calibration verification consists of verification of the Mid-Point Calibration Standard (CS3) RR and RRF.	1. Calibration Verification technical acceptance criteria must be met before any samples, QC samples, and required blanks are analyzed. Any analysis conducted when the technical acceptance criteria have not been met will require re-analysis. 2. If the technical acceptance criteria at the end of the 12-hour shift or analytical sequence are not met, all samples analyzed in that shift or analytical sequence will be reanalyzed. 3. If the calibration verification technical acceptance criteria are not met, inspect the system for problems.	Analyst/ Supervisor	
HRGC/HRMS	System Tune	At the beginning of each 12-hour shift and before analysis of any samples, blanks, or Calibration Standards	Descriptors must meet requirements of Table 7 in method.	Re-tune.	Analyst/ Supervisor	CBC01.2 PCB Congeners
	Ion Abundance Ratios	At the beginning of each 12-hour shift after the system tune and before analysis of any samples, blanks, or Calibration Standards	All CB congeners and labeled compounds in the CS1 Standard must be within the QC limits (Table 8) of method.	MS must be adjusted and the test repeated until the m/z ratios fall within the limits specified.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Signal to Noise Ratios	At the beginning of each 12-hour shift after the system tune and before analysis of any samples, blanks, or Calibration Standards	≥10	MS must be adjusted and the test repeated until this requirement is met.	Analyst/ Supervisor	
	WDM	After the HRMS PFK tune and before any initial calibration and Once at the beginning of each 12-hour period	The analysis of the WDM is acceptable if the criteria in Section 9.5.2, 9.5.3, and 9.5.5 of the method are met.	Technical acceptance criteria for the WDM must be met before any standards, samples, QC samples, and required blanks are analyzed. Any analysis conducted when the technical acceptance criteria have not been met will require reanalysis at no additional cost to USEPA. If the technical acceptance criteria for the WDM are not met, the instrument must be adjusted and the test repeated or the HRGC column must be replaced.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Initial Calibration	Each HRGC/HRMS system must be calibrated prior to analysis of samples under the contract, whenever the Contractor takes corrective action that may change or affect the initial calibration criteria, or if the calibration verification technical acceptance criteria are not met	%RSD of RRs must be within 20%. RRF of Internal Standards must meet requirements of Table 2 in the method.	If the initial calibration technical acceptance criteria are not met, inspect the system for problems. It may be necessary to change columns, adjust the system, and recalibrate until all the technical acceptance criteria are met. All initial calibrations' technical acceptance criteria must be met before any, samples, LCS, or blanks are analyzed. Any analysis conducted when the technical acceptance criteria have not been met will require reanalysis at no additional cost to USEPA.	Analyst/ Supervisor	
	Continuing Calibration	At the beginning of each 12-hour shift.	%D of each compound must meet the verification limit in Table 6	Inspect the system for problems. It may be necessary to change columns, adjust the system, and recalibrate. If recalibration is required, recalibration for the 209 congeners must also be performed.	Analyst/ Supervisor	
ICP-MS	Tuning Solution	5 Times consecutively before calibration	RSD of absolute signals must be < 5%	None.	Analyst/ Supervisor	ISM01.2 Metals
	Calibration	Daily	Two standards including a blank with a minimum of three replicate integrations.	Recalibrate	Analyst/ Supervisor	
	ICV	Daily, immediately after calibration	90-110%	Recalibrate	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	CCV	10% or every 2 hours whichever is more frequent	90-110%	Recalibrate	Analyst/ Supervisor	
	CRI	Beginning and end of analysis run, immediately before ICS	70 – 130% (50 – 150% for cobalt, manganese, and zinc)	Problem corrected, instrument recalibrated, re-run CRI, re-analysis of associated samples	Analyst/ Supervisor	
CVAA	Calibration Curve	Daily	Each standard within 5% of true value. Correlation coefficient ≥0.995	Recalibrate.	Analyst/ Supervisor	ISM01.2 Mercury
		Immediately after calibration	80 – 120%R	Problem corrected, instrument recalibrated, validate calibration	Analyst/ Supervisor	
	CCV	Beginning and end of run and 10% or every 2 hours	80 – 120%R	Problem corrected, instrument recalibrated, validate calibration, re-analysis of preceding 10 samples	Analyst/ Supervisor	
ICV	CRI	Immediately following ICV and 5%	70 – 130%R	Problem corrected, instrument recalibrated, re-run CRI, re-analysis of associated samples	Analyst/ Supervisor	
Spectrometer	Instrument Calibration (3 standards, one at CRQL)	Daily	Correlation coefficient ≥0.995	Recalibrate.	Analyst/ Supervisor	ISM01.2 Cyanide
	ICV	Immediately after Instrument Calibration	85 – 115%R	Problem corrected, instrument recalibrated, validate calibration	Analyst/ Supervisor	
	CCV	Every 10 samples or every 2 hours, whichever is more frequent.	85 – 115%R	Problem corrected, instrument recalibrated, validate calibration, reanalysis of preceding 10 samples	Analyst/ Supervisor	
	CRI	No less than one per 20 samples.	70 – 130%R	Problem corrected, instrument recalibrated, rerun CRI, re-analysis of associated samples	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
IC	Instrument Calibration (minimum of a blank and three standards)	Everyday.	Correlation coefficient ≥0.999	Recalibrate.	Analyst/ Supervisor	SW-846 7199 Hexavalent Chromium
	Quality Control Sample	Beginning of each analytical run and every 10 samples	90-110%R	A second analysis should be performed. If the measured concentration still exceeds ± 10% the established value, the analysis should be terminated until the source of the problem is identified and corrected.	Analyst/ Supervisor	

[1]SOPs from the Analytical SOP References table (Worksheet 23).
NOTE: Alkalinity is performed by titration therefore; no calibration of an instrument is required.

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	Check pressure and gas supply daily. Bake out trap and column, manual tune if not in criteria, change septa as needed, cut column as needed, change trap as needed.	Instrument Performance Check, Initial Calibration, Continuing Calibration Verification for VOC and SVOC analysis	Daily calibration activities	Must meet frequencies described in Worksheet 24.	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	SOM01.2
GC/ECD	Cleaning and replacement of detector. Replacement or baking of column.	Pesticide/PCB Analysis	Instrument performance, Initial Calibration, Calibration Verification	Must meet frequencies described in Worksheet 24.	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	SOM01.2
HRGC/HRMS	Check pressure and gas supply daily. Bake out trap and column, manual tune if not in criteria, change septa as needed, cut column as needed, change trap as needed.	Instrument Performance Check, Initial Calibration, Continuing Calibration Verification for target analyses	Daily calibration activities	Must meet frequencies described in Worksheet 24.	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	DLM02.0
ICP-MS	Change replacement parts as necessary.	Metals analysis	Instrument Calibration, ICV, CCV	Daily	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	ISM01.2

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
CVAA	Change or replace parts as necessary.	Mercury analysis	Instrument Calibration, ICV, CCV	Daily	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	ISM01.2
Spectrometer	Change or replace parts as necessary.	Cyanide analysis	Instrument Calibration, ICV, CCV	Daily	Must meet calibration criteria described in Worksheet 24.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. Record maintenance activities in logbook.	Analyst/ Supervisor	ISM01.2

[1]SOPs are from the Analytical SOP References table (Worksheet 23).

NOTE: Alkalinity is performed by titration; therefore, no instrument is required.

SAP Worksheet #26 – Sample Handling System

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): TBD/TtNUS
Sample Packaging (Personnel/Organization): TBD/TtNUS
Coordination of Shipment (Personnel/Organization): Eric Watt/TtNUS
Type of Shipment/Carrier: Overnight courier service (Federal Express)
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample custodians/Laboratory TBD
Sample Custody and Storage (Personnel/Organization): Sample custodians/ Laboratory TBD
Sample Preparation (Personnel/Organization): Preparation Laboratory Staff/ Laboratory TBD
Sample Determinative Analysis (Personnel/Organization): Analysts / Laboratory TBD
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days from submittal of final report
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 1 year from submittal of final report
SAMPLE DISPOSAL
Personnel/Organization: Sample custodians/Laboratory TBD
Number of Days from Analysis: 60 days from submittal of final report

SAP Worksheet #27 – Sample Custody Requirements

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Following sample collection into the appropriate bottleware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble wrap in order to protect the bottleware during shipment. The cooler will be secured using duct or clear packaging tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. Samples will be maintained at 4±2 °C until delivery to the laboratories. Proper custody procedures will be followed throughout all phases of sample collection and handling. Chain of custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with CLP Guidance for Field Samplers (USEPA, 2010) and TtNUS SOP SA-6.1.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

Procedures outlined in CLP SOWs. DAS parameter procedures will be according to laboratory specific SOPs and USEPA requirements.

Sample Identification Procedures:

Sample nomenclature will be conducted as outlined in Worksheet 14 and listed in Worksheet 18.

Samples to be used for matrix spikes/matrix spike duplicates will be labeled MS/MSD on the bottle label and noted on the chain-of-custody, as required in the laboratory QA Plan; however, “MS/MSD” will not be part of the unique sample identifier in order to maintain consistency with the project database.

The USEPA sample tracking software, Forms II Lite will be used to assign unique CLP sample identification for each sample.

Chain-of-custody Procedures:

After recovery, each sample will be maintained in the sampler’s custody until formally transferred to another party (e.g., Federal Express). For all samples recovered, custody records will document the date and time of sample collection, the sampler’s name, and the names of all other who subsequently held custody of the samples. Specification for chemical analyses will also be documented on the custody record. All sample information will be maintained in Form II Lite. The Traffic Report/Chain-of-Custody (TR/COC) will be generated by Forms II Lite in addition to the sample bottle labels and tags.

SAP Worksheet #28 – Laboratory QC Samples Table

☐ Worksheet Not Applicable (State Reason)

Laboratory QC Samples Table

Matrix	**Groundwater**
Analytical Group	**VOCs**
Concentration Level	Trace
Sampling SOP	SA-1.1
Analytical Method	SOM01.2 Trace
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	47 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Trip Blank	One per cooler of VOC samples shipped to laboratory	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Reanalyze blank and report with qualifiers.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
Method Blank	One every 12 hours prior to sample analysis	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
Deuterated Monitoring Compounds (DMC)	At least 3 per sample	See Table 5 of Method	Up to three DMCs per sample may fail to meet the recovery limits in Table 5. Check calculations, DMC spiking solutions, and instrument performance and then reanalyze sample.	Laboratory	Accuracy / Bias	%Rs must be within limits set in Table 5 of Method.
Internal Standards (IS)	3 per sample	Retention time $\pm$ 20 seconds; Extracted Ion Current Profile (EICP) area within 60-140% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time $\pm$ 20 seconds; EICP area within 60-140% of last CCV (12 hours) for each IS.

Matrix	**Groundwater**
Analytical Group	**SVOCs, PAHs, 1,4-Dioxane**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	SOM01.2 Low/SIM
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One every 12 hours prior to sample analysis	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
DMC	At least 3 per sample	See Table 5 of Method	Up to three DMCs per sample may fail to meet the recovery limits in Table 5. Check calculations, DMC spiking solutions, and instrument performance and then reanalyze sample.	Laboratory	Accuracy / Bias	%Rs must be within limits set in Table 5 of Method.
IS	3 per sample	Retention time $\pm$ 20 seconds; EICP area within 60-140% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time $\pm$ 20 seconds; EICP area within 60-140% of last CCV (12 hours) for each IS.

Matrix	**Groundwater**
Analytical Group	**Pesticides/PCB**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	SOM01.2
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One every 12 hours prior to sample analysis	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
Instrument Blank	One every 12 hours prior to sample analysis	No target compounds >CRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL
Laboratory Control Sample (LCS)	One per 20 environmental samples	%R requirements in method tables.	Recalculate, check spike solutions, or recalibrate if necessary.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	%R requirements in method tables.
MS/MSD	One per 20 environmental samples	%R requirements in method tables.	Recalculate, check spike solutions, or recalibrate if necessary.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	%R requirements in method tables.
Surrogates	3 per sample	30-150%; up to one surrogate may fail.	Re-prep and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	30-150%; up to one surrogate may fail.
IS	3 per sample	Retention time $\pm$ 20 seconds; EICP area within 60-140% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time $\pm$ 20 seconds; EICP area within 60-140% of last CCV (12 hours) for each IS.

Matrix	**Groundwater**
Analytical Group	**Dioxins/Furans**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	DLM02.0
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One every 12 hours prior to sample analysis	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
IS and Cleanup Standards	9 standards, see Method Table 1	25-150% R	Re-prep and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	25-150% R
LCS/LCSD	One per extraction batch of 20 or less	70-130% R RPD ≤20%	Re-extract and reanalyze if low recovery. Flag associated samples.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	70-130% R RPD ≤20%
MS/MSD	One per extraction batch of 20 or less	70-130% R RPD ≤20%	Re-extract and reanalyze if low recovery. Flag associated samples.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	70-130% R RPD ≤20%
Laboratory Duplicate	One per 20 samples	RPD≤50%	Note in narrative, qualify data.	Analyst, Laboratory Supervisor and Data Validator	Precision	RPD≤50%

Matrix	**Groundwater**
Analytical Group	**PCB Congeners**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	CBC01.2
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per extraction batch of 20 or less	No target compounds >CRQL	The source of the contamination must be investigated and appropriate corrective measures taken and documented before further sample analysis proceeds.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL
LCS	One per extraction batch of 20 or less	The %R of each of the compounds in the LCS must be within the acceptance limits in Table 6 of the method. Up to three target compounds may fail to meet the recovery limits listed in Table 6.	Re-extract and reanalyze if low recovery. Flag associated samples.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	70-130% R RPD ≤20%

Matrix	**Groundwater**
Analytical Group	**TAL Metals**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	ISM01.2 ICP-MS
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank (PB)	1 for each batch or Sample Delivery Group (SDG)	No target analytes >CRQL	If the blank concentration >CRQL, it must be < 10x the lowest concentration in the samples. If not, samples must be re-digested and analyzed with appropriate QC for that analyte.	Laboratory	Bias / Contamination	No target analytes >CRQL
Initial and Continuing Calibration Blanks (ICB/CCB)	After each calibration verification	Absolute value of target analytes >CRQL	Problem must be corrected, the instrument recalibrated, the calibration verified, and re-analysis of the preceding 10 analytical samples or all analytical samples analyzed since the last compliant calibration blank shall be performed for the elements affected.	Laboratory	Bias / Contamination	Absolute value of target analytes >CRQL
Interference Check Sample (ICS)	1 per 20 samples	±3x CRQL or ±20% of true value	Correct problem, recalibrate instrument, re-digest and analyze samples since last good ICS	Laboratory	Accuracy / Bias	±3x CRQL or ±20% of true value
MS	1 per batch or SDG	75 – 125%R	Flag with "N" and perform post digestion spike.	Laboratory	Accuracy / Bias	75 – 125%R
Laboratory Duplicate	1 per batch or SDG	20% RPD, use CRQL if one value below the CRQL	Flag data with "*".	Laboratory	Precision	20% RPD, use CRQL if one value below the CRQL

Matrix	**Groundwater**
Analytical Group	**TAL Metals**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	ISM01.2 ICP-MS
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	33 Groundwater

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample (LCS)	1 per batch or SDG	80 – 120%R	Correct problem, re-digest and analyze samples with new QC.	Laboratory	Accuracy / Bias	80 – 120%R
Serial Dilution	1 per batch or SDG	If analyte 50x Method Detection Limit (MDL), then RPD within 10%	Interference must be suspected, flag the result as "E"	Laboratory	Accuracy / Bias	If analyte 50x MDL, then RPD within 10%
IS	At least 5 per sample	Response within 60-125% of original response in calibration blank.	Check calculations, spike solution, and instrument performance. Dilute sample by 2 and add IS, reanalyze. Take corrective action to technical acceptance criteria. Narrate.	Laboratory	Precision / Accuracy / Bias	Response within 60-125% of original response in calibration blank.

SAP Worksheet #29 – Project Documents and Records Table

Project Documents and Records Table

Document	Where Maintained
Field Documents Field Logbook Field Sample Forms TR/COC Records Air bills Sampling Instrument Calibration Logs Sampling Notes Drilling Logs Photographs Field Task Modification Forms This SAP HASP	Field documents will be maintained in the project file located in the Tetra Tech Delaware office.
Laboratory Documents Sample receipt, custody, and tracking record Standards traceability logs Equipment calibration logs Sample preparation logs Analysis Run logs Equipment maintenance, testing, and inspection logs Corrective action forms Reported field sample results Reported results for standards, QC checks, and QC samples Sample storage and disposal records Telephone logs Extraction/clean-up records Raw data Data Completeness checklist	Laboratory documents will be included in the hardcopy and Portable Document Format (PDF) deliverables from laboratory to Region III Environmental Services Assistance Team (ESAT). The final data validation reports will be provided by ESAT to Tetra Tech in PDF format. The files will be maintained in the project file located in the Tetra Tech Delaware office. Electronic data results will be maintained in a password protected Access database.
Assessment Findings Field Sampling Audit Checklist (if conducted) Analytical Audit Checklist (if conducted) Data Validation Memoranda (includes tabulated data summary forms)	All assessment documents will be maintained in the Tetra Tech Delaware project file.
Reports Field Reports	All reports for the LCDA Clearview Landfill project will be stored in hardcopy in the Tetra Tech Delaware project file.

SAP Worksheet #30 – Analytical Services Table

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address, Contact Person and Telephone Number
Groundwater	VOC*	Trace	See Worksheet #18	SOM01.2 Trace	28 days	Laboratories TBD	NA
Groundwater	SVOC*	Low		SOM01.2 Low	28 days		
Groundwater	PAHs and 1,4-Dioxane*	Low		SOM01.2 SIM	28 days		
Groundwater	Total and Dissolved TAL Metals*	Low		ISM01.2 ICP-MS	28 days		
Groundwater	Dioxins and Furans	Low		DLM02.0	28 days		

*** Groundwater samples during packer testing require 48-hours preliminary data, accelerated TAT and final data in 14 days.**

SAP Worksheet #31 – Planned Project Assessments Table

Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Action (Title and Organizational Affiliation)
Field Sampling*	TBD*	Internal	Tetra Tech	QA Officer, Tetra Tech	FOL and/or PM, Tetra Tech	FOL and/or PM, Tetra Tech	FOL and/or PM, Tetra Tech
Health and Safety*	Annually	Internal	Tetra Tech	H&S Officer, Tetra Tech	FOL and/or PM, Tetra Tech	FOL and HSM, Tetra Tech	HSM, Tetra Tech
CLP Laboratory Audit	Annually	External	USEPA Region III OASQA	TBD, USEPA Region III OASQA	Laboratory Manager	Laboratory Manager	USEPA Personnel and Laboratory Manager

*No assessments are planned for this event. The requirements above are contractual requirements. In the event that an assessment is performed, this table will apply.

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses

Assessment Findings and Corrective Action Responses[1]

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Health and Safety Audit	Audit checklist and written audit finding summary	PM Tetra Tech, FOL Tetra Tech, and Program Manager Tetra Tech	Dependant on findings, if major, a stop work may be issued immediately, however, if minor, within 1 week of audit.	Written memo	HSM, Tetra Tech, Auditor Tetra Tech, Program Manager Tetra Tech	Within 48 hours of notification
Field Sampling	Audit checklist and written audit finding summary	PM Tetra Tech, FOL Tetra Tech, and Program Manager Tetra Tech	Dependant on findings, if major, a stop work may be issued immediately, however, if minor, within 1 week of audit.	Written memo	QAM, Tetra Tech, Auditor Tetra Tech, Program Manager Tetra Tech	Within 48 hours of notification

[1] Laboratory audit findings for the CLP are the responsibility of the USEPA Quality Assurance Team.

SAP Worksheet #33 – QA Management Reports Table

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Data Validation Report	Per SDG	28 Days after submittal of the last sample from the laboratory	USEPA Region III ESAT	PM Tetra Tech
Field Progress Reports	Daily, oral, during the course of sampling	Every day that field sampling is occurring	FOL (Tetra Tech)	PM Tetra Tech
Major analytical problem identification via email or phone call	When persistent analytical problems are detected	Immediately	CLP Laboratory and USEPA Region III Client Services Team	PM Tetra Tech, QAM Tetra Tech

SAP Worksheet #34 – Verification (Step I) Process Table

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Sample Tables	Proposed samples verified to have been collected	Internal	FOL or designee Tetra Tech
Chain of custody	Chain of custody records will be reviewed internally and compared against sample tables listing the proposed samples to verify that all planned samples have been collected.	Internal / External	Internal by PM or designee Tetra Tech External by USEPA Region III ESAT
Sample Coordinates	Sample locations have been verified to be correct and in accordance with the SAP (overlay maps proposed locations against actual locations)	Internal	FOL, PM, or designee (Tetra Tech)
Data package	Verify that the data package contains all the elements required by the functional guidelines and scope of work, this occurs as part of the data validation process.	External	USEPA Region III ESAT
Sample Log Sheets	Log sheets completed as samples are collected in the field are verified for completeness and are maintained at the project office.	Internal	PM or designee (Tetra Tech)

SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa (M3, IM2)	Data package	Validator will verify that elements of the data package that are required for validation is present and if not the lab will be contacted and the missing info will be requested. Validation will be performed as per Worksheet 36.	USEPA Region III ESAT
IIa	Field logbook	Verify that sampling plan was implemented and carried out as written and any deviations are documented.	PM Tetra Tech
IIa	Electronic Data	Verify all data have been transferred correctly and completely to the final Access database.	PM or designee Tetra Tech
IIa	SAP, field logbook, TR/COCs	Verify that deviations have been documented and MPCs have been achieved.	PM or designee Tetra Tech

[1] IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

SAP Worksheet #36 – Validation Requirements for Samples

Validation Requirements for Samples

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
Borehole Screening samples/Packer Testing				
IIa and IIb (ZL)	Groundwater	VOCs	Zero level (ZL) data validation (data for screening purposes only)	NA
Monitoring Events				
IIa and IIb (M3)	Groundwater	TCL VOC, SVOC, PAHs, 1,4-Dioxane,, Dioxins/Furans	Region III Modifications to National Functional Guidelines for Organic Data Review (September 1994) and SAP Worksheets 12, 15, and 28. Innovative Approaches to Data Validation (June 1995)	USEPA Region III ESAT
IIa and IIb (IM2)	Groundwater		Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (April 1993) and SAP Worksheets 12, 15, and 28 to the extent possible. Innovative Approaches to Data Validation (June 1995)	USEPA Region III ESAT
IIa and IIb (IM2)	Groundwater	TAL Metals, Mercury, and Cyanide,	Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (April 1993) and SAP Worksheets 12, 15, and 28. Innovative Approaches to Data Validation (June 1995)	USEPA Region III ESAT

IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]

1 IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

SAP Worksheet #37 – Usability Assessment

Usability Assessment

A data usability assessment of the LDCA data will be conducted for VOC and inorganics by the planning team, including the Tetra Tech PM, project chemist, and other technical staff. This level of evaluation will be considered sufficient for the intended data use.

The data validation procedure (Worksheets 35 and 36) will help determine which data are usable. Qualifiers will be applied to each value based on the results of the data validation. Rejected values (qualified with "R") and blank qualified values ("B") will be eliminated from further consideration. Estimated and biased values (J [estimated], K [biased high], and L [biased low]) will be used as the reported value.

After data validation and an overall review of data quality indicators, the data will be reconciled with MPCs (Tables 12, 28, and this worksheet for completeness) to determine whether sufficient data of acceptable quality are available for decision making. A series of inspections, and summaries, will be performed to estimate several of the data set characteristics. Simple summary statistics for target analytes will be presented in tabular format, such as the maximum concentration, minimum concentration, number of samples exhibiting no detectable analyte, the number of samples exhibiting detectable analytes, and the proportion of samples with detectable and undetectable analytes. Rejected values and significant deviations from planning documents, if any, will be identified so the planning team can assess their impacts to the attainment of project objectives. Project assumptions will also be evaluated to determine their validity. If assumptions are shown to be invalid the team will assess the impact of the invalid assumption and take actions necessary to mitigate the impact. In extreme cases, a revision of DQOs may be necessary.

The quantitative bias and precision data quality indicators will be reviewed to determine whether any significant bias or significant imprecision exist in the data. At the discretion of the project manager correlations may also be assessed among various parameters as a cross-check to ensure that results appear to be reasonable. Although bias and precision indicators can be assessed quantitatively, evaluations will involve professional judgment which will consider site conditions, the normal analytical performance for the analytes in question, and other factors that affect the precision and agreements among analyte concentrations. The intent will be to identify any deviations or anomalies that adversely affect the ability to attain project objectives and to document how these characteristics were handled by the team to complete the project.

Precision
The project chemist acting on behalf of the project team will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing RPD values from duplicate results to precision goals identified in Worksheets 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier); then the limitations on the use of the data will be described in the project report.

RPD values will be computed as follows:

$$RPD = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{0.5\,(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \times 100$$

Accuracy
The project chemist acting on behalf of the project team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, MS, MSD, DMC, and surrogate compounds to accuracy goals identified in Worksheet 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for DMC and surrogates, MS, and LCS. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

The %R for a spiked sample will be calculated by using the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100\ \%$$

The %R calculation for LCSs and surrogate spikes will be as follows:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Certified or Known Concentration}} \times 100\ \%$$

Potential data outliers will also be investigated to determine whether they represent unanticipated site conditions or they are true outliers. No statistical outlier will be removed from a data set unless a physical reason can be assigned to the datum to demonstrate that it is not representative of the intended population.

Representativeness
A project scientist identified by the PM and acting on behalf of the project team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

The project chemist acting on behalf of the project team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project chemist indicates that such quantitative analysis is required.

Completeness

For each matrix sampled, the FOL acting on behalf of the project team will prepare a table comparing planned samples/analyses to samples/analyses collected. If deviations from the scheduled sample collection or analyses are identified, the PM and project chemist will determine whether the deviations compromise the ability to meet project objectives. If they do, the PM will consult with the RPM and other project team members, as necessary (determined by the RPM), to develop appropriate corrective actions.

Activity	Data Type	Completeness Goal
Well Mapping	-Horizontal/Vertical Survey Data	90%
Hydrogeologic characterization of bedrock	-Water Level Measurements -Borehole Packer Test Data -Hydrogeological characteristics -Groundwater Analytical Concentration Data (screening purposes)	95% TBD - Dependent upon well yield TBD - Dependent upon well yield TBD - Dependent upon well yield
Boring installation to better evaluate COCs extent in the bedrock	-Water Level Measurements -Geophysical logs -Groundwater Analytical Concentration Data (formation water) -Groundwater general water quality data (field data)	-95% -Will log each borehole -Will collect a groundwater sample from each borehole -Will measure field parameters at borehole
Groundwater Sampling of Newly Installed and Existing Wells	-Water Level Measurements -Groundwater Analytical Concentration Data -Groundwater general water quality data (field data)	95% -Will collect a groundwater sample by low-flow methods from each well -Will measure field parameters during sampling of each well

Sensitivity

The project chemist acting on behalf of the project team will determine whether project sensitivity goals listed in Worksheet 15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The project chemist will enlist the help of the project team to evaluate deviations from planned sensitivity goals.

Data Limitations and Actions from Usability Assessment

After all data evaluations are completed, any limitations on the use of data will be known to the planning team and the limitations will be considered during decision making. If necessary, investigation objectives may be revised in anticipation of additional data collection in order to meet project quality objectives for the site. The data usability assessments for each stage of the RA plan will be summarized in the final report for that phase.

REFERENCES

USEPA (U.S. Environmental Protection Agency), 2006. Guidance on Systematic Planning using the Data Quality Objectives Process. EPA QA/G-4, EPA/240/B-06/001. USEPA Office of Environmental Information, Washington DC. February.

USEPA, 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5, EPA/240/R-2/009. USEPA Office of Environmental Information, Washington DC. December.

TtNUS, Amended Letter Work Plan and Budget Estimate, Lower Darby Creek Area Site (Clearview Landfill), Philadelphia, PA, October 2010.